

Ac 1

CEYLON

MEDICAL

1924

---





# CEYLON

Scale, 8 Miles to an Inch

1 : 506,890

## REFERENCE

PRINCIPAL ROADS

TANKS (RESTORED)

MINOR Do

Do (RESTORED)

CART TRACKS

VILLUS, MARSHES &c

PATHS

LIGHTHOUSES

TELEGRAPH LINES

REST HOUSES

RAILWAYS (EXISTING)

HOSPITALS

Do (UNDER CONSTRUCTION)

DISPENSARIES

PROVINCE BOUNDARIES

POST & TELEGRAPH OFFICES

TOWNS

P.O.

Police Stations

P.D.

Published under the direction of Mr. A. J. Wickwar F. R. G. S. Surveyor General, Ceylon

REFERENCE

HOSPITALS

CENTRAL DISPENSARIES

BRANCH DISPENSARIES & VISITING STATIONS

Do

# MEDICAL.

## REPORT OF THE PRINCIPAL CIVIL MEDICAL OFFICER AND INSPECTOR-GENERAL OF HOSPITALS FOR THE YEAR 1924.

### TABLE OF CONTENTS.

| Sub-section.                                   | PAGE | Sub-section.   | PAGE | Sub-section.  | PAGE |  |  |
|--|------|--|------|---|------|--|--|
| <b>SECTION I.—ADMINISTRATIVE.</b>              |      |  |      |   |      |  |  |
| 2 Staff ..                                     | 1    | 25 Parangi ..  | 25   | <b>SECTION VI.—MISCELLANEOUS.</b>   |      |  |  |
| 3 Promotions and Appointments ..               | 1    | 26 Plague ..   | 25   | 41 King Edward VII. (Memorial) Anti-Tuberculosis Fund ..  | 40   |  |  |
| 4 Officers on Leave ..                         | 2    | 27 Port Health Precautions ..  | 25   | 42 The Ceylon Medical College ..  | 41   |  |  |
| 5 Financial ..                                 | 2    | <b>SECTION III.—THE SANITARY BRANCH OF THE MEDICAL DEPARTMENT.</b>                       |      |   |      |  |  |
| <b>SECTION II.—POPULATION : PUBLIC HEALTH.</b> |      |  |      |   |      |  |  |
| 6 Estimated Population ..                      | 2    | 28 Report submitted by the Sanitary Commissioner ..                                      | 25   | 43 Civil Medical Stores ..  | 42   |  |  |
| 7 Vital Statistics ..                          | 2    | <b>SECTION IV.—METEOROLOGY.</b>  |      |   |      |  |  |
| 8 Causation of Deaths ..                       | 2    | 29 Rainfall ..   | 35   | 44 Opium ..   | 43   |  |  |
| 9 Notable Causes of Deaths ..                  | 3    | 30 Temperature ..  | 36   | 45 Medical Work in Connection with Railway Extensions ..  | 43   |  |  |
| 10 Infantile Mortality ..                      | 3    | <b>SECTION V.—HOSPITALS, ASYLUMS, AND DISPENSARIES.</b>                                  |      |   |      |  |  |
| 11 Vital Statistics on Estates ..              | 3    | 31 Number of Institutions and Number of Beds available for In-Patients ..                | 36   | 46 Medical Inspection of Schools ..   | 43   |  |  |
| 12 Malaria ..                                  | 3    | 32 General Hospital, Colombo ..  | 36   | 47 Medical Aid to Immigrant Coolies ..  | 44   |  |  |
| Report of the Malariaologist ..                | 3    | 33 Lunatic Asylum, Colombo ..  | 38   | Medical Inspection of Estates ..  | 46   |  |  |
| 13 Cholera ..                                  | 12   | 34 De Soysa Lying-in Home ..   | 38   | 48 Medical and Sanitary Requirements ..   | 46   |  |  |
| 14 Smallpox ..                                 | 12   | 35 The Victoria Memorial Eye Hospital and the Grenier Ear, Nose, and Throat Infirmary .. | 38   | <b>SECTION VII.—SCIENTIFIC.</b>   |      |  |  |
| 15 Vaccination ..                              | 12   | 36 The Lady Havelock Hospital for Women and The Lady Ridgeway Hospital for Children ..   | 38   | 49 Government Bacteriological and Pasteur Institutes ..   | 46   |  |  |
| 16 Government Vaccine Establishment ..         | 12   | 37 Police Hospital, Borella ..   | 39   | 50 Summary of Results of Research Work Done, Municipal Bacteriological Laboratory ..                                | 48   |  |  |
| 17 Enteric Fever ..                            | 12   | 38 Infectious Diseases Hospital, Colombo ..  | 39   | 51 Spinal Analgesia, by Dr. L. A. E. de Zilwa ..  | 49   |  |  |
| 18 Diplitheria ..                              | 12   | 39 The Convict Hospitals ..  | 39   | 52 A Brief Résumé of a Few Interesting Cases, by Dr. A. M. de Silva ..  | 49   |  |  |
| 19 Influenza ..                                | 12   | 40 Medical Institutions aided by Government ..   | 39   | 53 Some Important Factors in the Causation of Diabetes Mellitus, by Dr. Lionel de Silva ..                          | 50   |  |  |
| 20 Dysentery ..                                | 13   | <b>SECTION I.—ADMINISTRATIVE.</b>  |      |   |      |  |  |
| 21 Cancer and Sarcoma ..                       | 13   | <b>SECTION II.—POPULATION : PUBLIC HEALTH.</b>   |      |   |      |  |  |
| 22 Anchylostomiasis ..                         | 13   | 25 Parangi ..  | 25   | 54 A Summary of Work Done in the Pathological Department, General Hospital, Colombo, by Dr. W. A. E. Karunaratne .. | 51   |  |  |
| Anchysotomiasis Campaigns ..                   | 14   | 26 Plague ..   | 25   | 55 Splenectomy ..   | 52   |  |  |
| 23 Tubercular Diseases of the Lungs ..         | 24   | 27 Port Health Precautions ..  | 25   | 56 Stovarsol ..   | 53   |  |  |
| Anti-Tuberculosis Institute, Colombo ..        | 24   | <b>SECTION III.—THE SANITARY BRANCH OF THE MEDICAL DEPARTMENT.</b>                       |      |   |      |  |  |
| Kandana Sanatorium ..                          | 24   | 41 King Edward VII. (Memorial) Anti-Tuberculosis Fund ..                                 | 40   | 57 Report of Malariaologist ..  | 53   |  |  |
| Ragama Hospital for Chronic Cases ..           | 24   | 42 The Ceylon Medical College ..   | 41   | <b>SECTION VI.—MISCELLANEOUS.</b>   |      |  |  |
| 24 Leprosy ..                                  | 24   | 43 Civil Medical Stores ..   | 42   |   |      |  |  |

I HAVE the honour to submit the following report on the health and sanitary condition of Ceylon and on the administration of the institutions of the Ceylon Civil Medical Department for the year ended December 31, 1924.

### SECTION I.—ADMINISTRATIVE.

2. *Staff.*—Principal Civil Medical Officer; Assistant Principal Civil Medical Officer; Sanitary Commissioner; Assistant Sanitary Commissioner; Director of the Bacteriological Institute and Pasteur Institute; Malariaologist; 9 Provincial Surgeons; 4 Medical Superintendents; 3 Inspecting Medical Officers of Estates; 60 Medical Officers, Grade I., including 3 Lady Doctors and 1 Medical Superintendent; 170 Medical Officers, Grade II., including 3 Assistant Inspecting Medical Officers of Estates and 2 Lady Doctors; 1 Medical Officer in charge of the Anti-Tuberculosis Institute, Colombo; 2 Anaesthetists; 11 Medical Officers of Health; 1 Sanitary Engineer; 1 Sanitary Superintendent; 3 Supervising Sanitary Inspectors; 175 Sanitary Inspectors; 1 Female Medical Practitioner; 364 Apothecaries; 34 European Matrons and Sisters; 84 European Religious Mothers and Sisters in the Nursing Service; 296 Ceylonese Matrons, Nurses, and Pupil Nurses; 1 Hospital Assistant in the Borella Convict Hospital; 39 Hospital Stewards; 9 Inspectors of Vaccination; 137 Male Vaccinators; 12 Female Vaccinators; Principal Civil Medical Officer's Office: Financial Branch—Accountant, Book-keeper, Cashier, and 29 Clerks; General Branch—Chief Clerk in the Special Class of the Clerical Service and 24 Clerks; Civil Medical Stores: 1 Superintendent and Chief Storekeeper, 2 Assistant Superintendents, 1 Opium Storekeeper, 14 Clerks, 40 Opium Clerks and Sellers approximately 2,100 minor employees in Offices, Stores, Institutes, Hospitals, Dispensaries, and Sanitary Branch.

3. *Promotions, Appointments, &c.*—The Hon. Dr. J. F. E. Bridger, Sanitary Commissioner, succeeded the Hon. Dr. G. J. Rutherford, who retired from the service, as Principal Civil Medical Officer and Inspector-General of Hospitals on December 17, and Dr. G. Thornton, Assistant Principal Civil Medical Officer and Inspector-General of Hospitals, was appointed to act as Principal Civil Medical Officer and Inspector-General of Hospitals during the Hon. Dr. Rutherford's three months' leave preparatory to retirement and the Hon. Dr. Bridger's absence from the Island.

Dr. J. C. Cooke, Provincial Surgeon, Western Province, acted as Assistant Principal Civil Medical Officer and Inspector-General of Hospitals, and Dr. S. T. Gunasekera as Sanitary Commissioner. Dr. E. N. Jan, Medical Officer, Grade I., was promoted to grade of Provincial Surgeon. Drs. S. Thampi-pillai and D. D. S. Ootschoorn were promoted from Grade II. to Grade I. Drs. C. B. Lourensz and A. Rode, Provincial Surgeons, and Dr. A. Nell, Surgeon in charge of the Victoria Memorial Eye Hospital, retired during the year. Dr. C. Kanagasundram died on December 9.

4. *Officers on Leave.*—The Assistant Principal Civil Medical Officer was absent on leave from February 6 to August 25. The Hon. Dr. G. J. Rutherford, Principal Civil Medical Officer and Inspector-General of Hospitals, left the Island on September 17 on three months' leave preparatory to retirement. The Sanitary Commissioner proceeded to Europe on October 16 on six months' leave. Eighteen Medical Officers were on long leave in Europe at the beginning of the year, 23 proceeded to Europe, and 17 returned to the Island during the year.

5. *Financial.*—Revenue and expenditure in 1923-24:—

| EXPENDITURE.   |           |    |  |           |    |
|--|-----------|----|--|-----------|----|
|  | Rs.       | c. | Rs.  | c.        |    |
| Salaries, wages, &c. . .                               | 3,691,122 | 33 | Incidental expenses . .                      | 14,779    | 14 |
| Diets . . .  | 1,345,059 | 90 | Purchase of opium, &c. . .                   | 16,893    | 19 |
| Equipment and contingencies . . .                      | 398,631   | 81 | Compensation for loss in opium revenue . . . | 83,902    | 12 |
| Medicines and instruments . . .                        | 956,588   | 97 | Anchylostomiasis campaign . . .              | 78,467    | 79 |
| Bacteriological Institute, &c. . .                     | 27,102    | 62 |  |           |    |
| Tuberculosis Institute, Sanatorium, and Hospital . . . | 84,615    | 29 |  |           |    |
| Transport and travelling . . .                         | 353,857   | 31 |  |           |    |
| Rents . . .  | 43,390    | 86 |  |           |    |
| Grants . . .   | 12,250    | 0  |  |           |    |
| Sanitation and epidemics . . .                         | 55,578    | 99 |  |           |    |
| Special equipment . . .                                | 23,274    | 19 |  |           |    |
|  |           |    | Total . . .                                  | 7,250,657 | 20 |

| REVENUE.  |         |    |                                      |           |    |
|---|---------|----|--------------------------------------|-----------|----|
|   | Rs.     | c. | Rs.                                  | c.        |    |
| Hospital and dispensary receipts . . .                | 260,107 | 9  | Sale of opium . . .                  | 501,404   | 69 |
| Sale of drugs, &c. . .                                | 22,222  | 36 | Medical aid dues export duties . . . | 903,610   | 3  |
| Sale of drugs under the Medical Wants Ordinance . . . | 8,102   | 49 |                                      |           |    |
| Medical aid dues, maintenance, and visits             | 158,654 | 12 | Total . . .                          | 1,854,100 | 78 |

The following is a statement of the total expenditure during the last five years:—

|               | Rs.        | c. | Rs.           | c.        |    |
|---------------|------------|----|---------------|-----------|----|
| 1919-20 . . . | 5,287,241  | 27 | 1922-23 . . . | 5,524,453 | 70 |
| 1920-21 . . . | 5,388,791  | 45 | 1923-24 . . . | 7,250,657 | 20 |
| 1921-22 . . . | *5,633,096 | 46 |               |           |    |

\* Arrears of salary under the new Salaries Scheme.

SECTION II.—POPULATION: PUBLIC HEALTH.

6. The estimated population of Ceylon on December 31, 1924, inclusive of immigrant coolies, was 4,861,670. 10,005 of these were Europeans. An increase of 158,326 and 635 respectively over the previous year's estimate.

7. *Vital Statistics.*—178,866 births were registered, equivalent to an annual rate of 36.79 per thousand of the population, as compared with 181,441 births and an annual rate of 38.57 per thousand in 1923. 122,959 deaths were registered during the year, 141,894 the previous year; a decrease of 18,935 deaths during the year under review.

The death-rate for 1924 was 25.29 and for 1923, 30.16 per thousand.

8. *Causation of Deaths.*—The following table shows the number of deaths registered during the years 1923 and 1924 under the several classes of disease:—

|  | 1923.     | 1924.  | 1923.   | 1924.            |
|--|-----------|--------|---|------------------|
| I.—General diseases—   |           |        | V.—Diseases of the digestive system . . .                               | 20,780 .. 17,555 |
| (a) Epidemic diseases . . .  | 9,475 ..  | 8,879  | VI.—Non-venereal diseases of the genito-urinary system and annexa . . . | 1,387 .. 1,456   |
| (b) Septic diseases . . .  | 169 ..    | 117    | VII.—The puerperal state . . .  | 3,913 .. 3,417   |
| (c) Tuberculous diseases . . .                                       | 3,755 ..  | 3,564  | VIII.—Diseases of the skin and cellular tissues . . .                   | 11,777 .. 9,537  |
| (d) Venereal diseases . . .  | 285 ..    | 254    | IX.—Diseases of bones and organs of locomotion . . .                    | 16 .. 25         |
| (e) Cancer or malignant diseases . . .                               | 433 ..    | 473    | X.—Malformations . . .  | 21 .. 16         |
| (f) Other general diseases . . .                                     | 10,684 .. | 8,832  | XI.—Diseases of early infancy . . .                                     | 8,724 .. 8,653   |
| II.—Diseases of the nervous system and organs of special sense . . . | 18,725 .. | 16,011 | XII.—Old age . . .  | 4,822 .. 4,553   |
| III.—Diseases of the circulatory system . . .                        | 1,131 ..  | 1,015  | XIII.—Affections produced by external causes . . .                      | 2,435 .. 2,492   |
| IV.—Diseases of the respiratory system . . .                         | 14,573 .. | 13,114 | XIV.—Ill-defined diseases . . .   | 28,789 .. 22,996 |

9. The more notable causes of death were the following diseases:—

|                          | 1923.     | 1924.     |  | 1923.     | 1924.     |
|--------------------------|-----------|-----------|--|-----------|-----------|
| 1. Infantile convulsions | .. 16,166 | .. 13,899 | 10. Malaria  | .. 2,118  | .. 1,388  |
| 2. Diarrhoea             | .. 10,888 | .. 9,026  | 11. Ankylostomiasis and its sequelæ                | .. 1,857  | .. 1,853  |
| 3. Pneumonia             | .. 8,921  | .. 8,339  | 12. Puerperal septicæmia                           | .. 1,568  | .. 1,322  |
| 4. Rickets               | .. 5,097  | .. 4,078  | 13. Enteric fever                                  | .. 597    | .. 816    |
| 5. Intestinal parasites  | .. 4,257  | .. 3,246  | 14. Tetanus  | .. 241    | .. 269    |
| 6. Anæmia                | .. 3,416  | .. 2,692  | 15. Rabies   | .. 30     | .. 37     |
| 7. Dysentery             | .. 3,326  | .. 4,080  | 16. Deaths attributed to pyrexia of unknown origin | .. 23,328 | .. 17,697 |
| 8. Phthisis              | .. 3,322  | .. 3,235  |  |           |           |
| 9. Dropsy                | .. 2,862  | .. 2,580  |  |           |           |

A large number of the deaths registered under pyrexia of unknown origin were most probably due to malaria, as this disease is prevalent in the greater part of the Island.

10. *Infantile Mortality.*—The infant mortality rate in the 33 principal towns of the Island was 235 per thousand, as against 258 the previous year, 240 in 1922, and 238 in 1921, a gradual increase from 1921 to 1923, and a fall in 1924, due probably to the activities of Child-Welfare Associations, the establishment of crèches in principal towns and on estates, and the teaching of mother-craft in the training schools for pupil teachers. 13,899 deaths from infantile convulsions were registered during the year—11·3 per cent. of the total number of deaths registered. The corresponding figures for the previous year were 16,166 and 11·39 per cent. respectively. In the ante-natal clinic attached to the De Soysa Lying-in Home, Colombo, advice was given to 335 expectant mothers, who paid 343 visits during the year, as against 319 and 326 respectively the previous year and 216 and 226 respectively in 1922.

Fifty-seven midwives were trained at the Lying-in Home, Colombo, in 1924, 51 in 1923.

11. *Vital Statistics on Estates.*—21,944 births and 18,770 deaths were reported from estates during the year, as against 26,921 births and 17,551 deaths in 1923 and 24,527 births and 14,724 deaths in 1922. The birth-rate per 1,000 per annum calculated on the estimated estate population on December 31, 1924, was 41, and the death-rate 35 for the year, as against 57 and 28 respectively in the previous year and 50 and 32 respectively in 1922.

The following table shows the principal causes of death on estates:—

|                          | 1923.    | 1924.    |                   | 1923.    | 1924.    |
|--------------------------|----------|----------|-------------------|----------|----------|
| 1. Debility              | .. 3,558 | .. 4,050 | 6. Dysentery      | .. 1,248 | .. 2,402 |
| 2. Pneumonia             | .. 2,932 | .. 2,990 | 7. Phthisis       | .. 278   | .. 317   |
| 3. Infantile convulsions | .. 1,554 | .. 1,636 | 8. Dropsy         | .. 106   | .. 137   |
| 4. Ankylostomiasis       | .. 1,099 | .. 1,240 | 9. Other diseases | .. 5,804 | .. 6,275 |
| 5. Diarrhoea             | .. 972   | .. 1,495 |                   |          |          |

12. *Malaria* was prevalent to some extent during the year, and showed a slight decrease as regards hospital admissions and cases treated at dispensaries and hospital out-patient departments from the large numbers of the previous year.

26,856 hospital admissions and 925,476 dispensary cases were recorded during the year, as against 34,522 and 1,193,225 respectively in 1923 and 29,377 and 956,810 respectively in 1922.

1,388 deaths from malaria were registered in 1924, 2,118 in 1923, and 1,621 in 1922, but 17,697 deaths in 1924, 23,328 deaths in 1923, and 20,171 deaths in 1922 were registered under pyrexia of unknown origin, and many of these were probably due to malaria.

The following table shows the hospital admissions in the different Provinces and total dispensary cases for the last three years:—

#### Malaria.

##### Hospital Admissions:—

|                           | 1922.     |         | 1923.     |           | 1924.     |         |
|---------------------------|-----------|---------|-----------|-----------|-----------|---------|
|                           | Cases.    | Deaths. | Cases.    | Deaths.   | Cases.    | Deaths. |
| General Hospital, Colombo | .. 2,121  | .. 37   | .. 2,280  | .. 15     | .. 2,677  | .. 21   |
| Western Province          | .. 6,640  | .. 74   | .. 6,062  | .. 87     | .. 2,984  | .. 60   |
| Central Province          | .. 3,893  | .. 54   | .. 5,887  | .. 107    | .. 3,268  | .. 44   |
| Northern Province         | .. 1,978  | .. 15   | .. 2,158  | .. 19     | .. 2,634  | .. 57   |
| Eastern Province          | .. 755    | .. 4    | .. 867    | .. 11     | .. 1,903  | .. 45   |
| Southern Province         | .. 1,476  | .. 26   | .. 1,911  | .. 35     | .. 2,223  | .. 34   |
| North-Western Province    | .. 3,015  | .. 98   | .. 3,201  | .. 76     | .. 2,394  | .. 83   |
| North-Central Province    | .. 2,072  | .. 42   | .. 2,603  | .. 68     | .. 2,102  | .. 54   |
| Province of Uva           | .. 2,856  | .. 50   | .. 3,111  | .. 66     | .. 2,422  | .. 41   |
| Province of Sabaragamuwa  | .. 3,456  | .. 63   | .. 5,087  | .. 76     | .. 3,018  | .. 54   |
| Railway Extensions        | .. 1,115  | .. 6    | .. 1,355  | .. 8      | .. 1,240  | .. 11   |
| Total                     | .. 29,377 | 475     | .. 34,522 | 568       | .. 26,865 | 504     |
| Dispensary cases          | ..        | 956,810 | ..        | 1,193,225 | ..        | 925,476 |

Quinine to the value of Rs. 303,050 was issued free for preventive and curative purposes during the year. It was distributed by itinerating apothecaries and vaccinators on fever duty, and by headmen through the Government Agents during the fever seasons. The cost of the quinine issued free in 1923 was Rs. 276,120·96.

Report of the Malariaologist, Mr. H. F. Carter, for the year:—

Staff.—The Malariaologist, 3 Medical Officers (Drs. K. J. Rustomjee, E. T. Saravanamuttu, and W. L. P. Dassanayake), 8 entomological assistants, 1 laboratory assistant, 1 laboratory attendant, 1 clerk (Class III.), 1 peon, and 4 coolies (mosquito catchers).

The services of Acting Medical Officer, Dr. W. H. Schokman, were retained in connection with the anti-malaria campaign at Trincomalee.

A labour force of 45 to 50 coolies under 2 overseers and a kangany was maintained for the execution of anti-mosquito measures at Trincomalee and Anuradhapura ; and at the latter town was augmented by a gang of 35 to 45 convicts under the control of guards.

*Distribution of Staff, &c.*—The Malariaologist, 1 Medical Officer (Dr. E. T. Saravanamuttu), the laboratory assistant, the laboratory attendant, and the clerk were attached to the Colombo office.

Following a recommendation made by the Finance Committee of the Legislative Council in November, 1923, that an additional Medical Officer be attached to the staff for training purposes, Dr. W. L. P. Dassanayake was selected for the appointment. This officer assumed duties on March 3, 1924, and was attached to the Colombo office.

At the end of March, 1924, Dr. K. J. Rustomjee resumed duties at Colombo, and in addition took over the control of the anti-malaria campaigns at Trincomalee and Anuradhapura. The immediate direction and supervision of the works at the former town remained under Dr. W. H. Schokman.

The entomological assistants were stationed at the following towns, where laboratories were maintained :—Anuradhapura (2), Kurunegala (1), Jaffna (1), Badulla (1), Trincomalee (2), and Colombo (1). One assistant was transferred from Anuradhapura to Trincomalee, and 1 from Colombo to Anuradhapura in December.

On the recommendation of Government, Dr. K. J. Rustomjee was awarded, in December, a scholarship by the International Health Board, Rockefeller Foundation ; he will prosecute studies in public health, with special reference to malaria and its control, at the School of Hygiene and Public Health, Johns Hopkins University, and will leave Ceylon for this purpose in July, 1925.

*Education and Propaganda.*—Public lantern lectures in English and the vernaculars have been given at Anuradhapura, Trincomalee, Mullaitivu, Mannar, and Erukkulampidi, and lantern lectures and demonstrations at colleges and schools at Kandy and most of the above towns. Additions to the series of lantern slides and posters relative to the subject have been made, and on a few occasions selected slides have been loaned for propaganda purposes. Many thousands of pamphlets and handbills on malaria and mosquitoes have been distributed to towns and villages in various parts of the Island and at Anuradhapura and Trincomalee in connection with the anti-malaria campaigns.

A course of lectures and demonstrations on malaria and its control was given during July and August to the Training Class for Sanitary Inspectors held by the Sanitary Branch of the Medical Department.

With a view to encouraging medical officers and others to take up the study of the indigenous anopheline mosquitoes, a paper on the differential characters of the larvae and adults of the species known to occur in Ceylon has been prepared by the Malariaologist. Endeavour has been made to render this article as comprehensive as possible, in order that the student may be relieved of the necessity of consulting text-books and original papers relating to the subject. This paper will be published in the Ceylon Journal of Science (Section D : Medical Science) at an early date, and reprints will be distributed to hospitals and the larger dispensaries.

*Malaria Research.*—Summaries of some of the more important investigations completed during the past two years are given on page 53 *et seq.* As in previous years, these investigations have involved the examination of very large numbers of specimens, chiefly blood films and the larvae and adults of anopheline mosquitoes ; during the year, 3,091 blood films and 34,020 anopheline larvae collected in the field were prepared and examined at the Colombo and Trincomalee laboratories.

As indicated above, certain of the investigations mentioned in the report for the previous year have been completed ; others are in progress, including those initiated during the year. Of the latter, the more important are inquiries into the hydrogen Ion content of various types of natural waters with reference to the breeding and relative prevalence of anopheles, and the seasonal periodicity of the different species of malaria parasites in various districts.

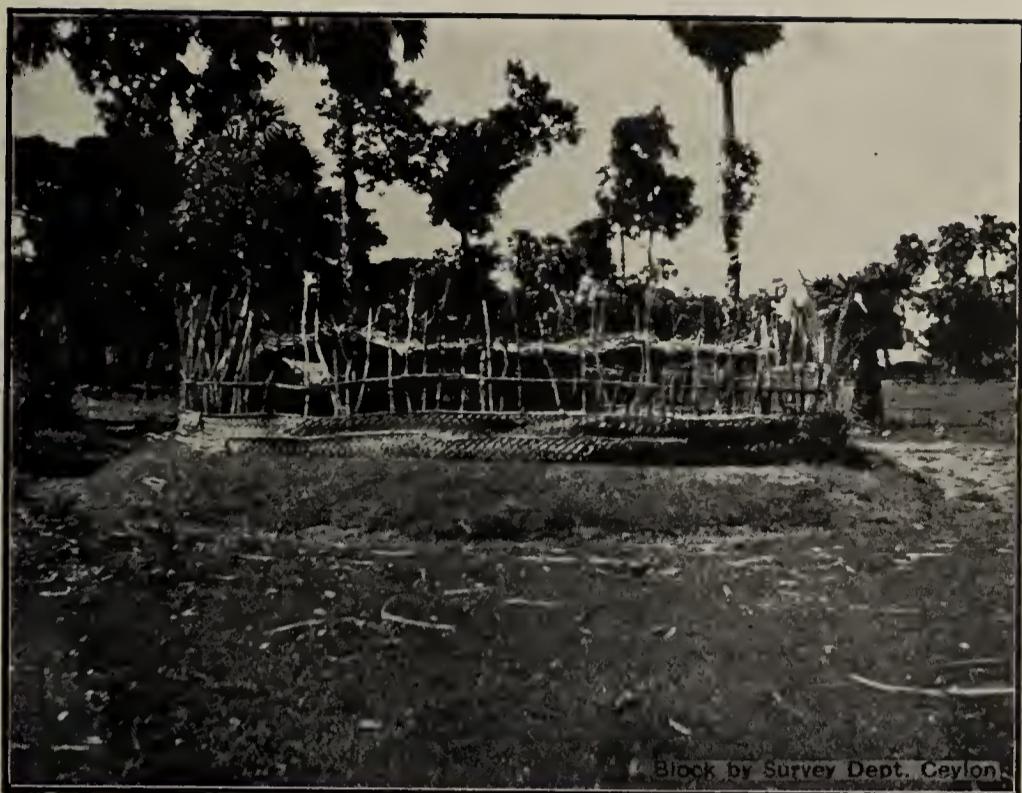
*Larvivorous Fish.*—The lines on which larvivorous fish may be utilized as a measure of mosquito control have been indicated in previous reports. The practical value of these fish is more limited than is generally supposed, and it is a mistake to imagine that under natural conditions they are of equal importance in all types of mosquito breeding places, or that they can be used to supplant the more laborious and costly methods of reduction at present adopted. Normally, their beneficial action is much restricted by nature's barriers, and it is doubtful whether, without human assistance, their presence in natural waters has any notable effect upon the prevalence of mosquitoes. Under artificial conditions—or in mosquito breeding places which are of a temporary nature only—they, however, afford an important measure of control ; and it is in this connection that their exploitation in Ceylon should ultimately prove of value. Especially should this be so in those parts of the dry zone where indigenous species do not appear to be abundant, and where innumerable confined and temporary collections of water occur during the rainy season. The formation of nurseries and systematic distribution of these fish at the onset of the monsoon to such situations as rain pools, borrow pits, wells, &c., should form part of any campaign against malaria in these districts.

The nurseries of *Gambusia affinis* (? *Lebistes reticulatus*)—“ Millions ”—mentioned in earlier reports have been maintained, and except in one case where contamination with oil occurred, have proved very satisfactory. The fish have increased greatly in numbers, the nurseries being well stocked, even although extensive distribution to wells and pools has taken place in certain districts. In some parts of the dry zone, however, it has been found necessary to protect the nurseries with netting or cadjans owing to the prevalence of kingfishers ; these birds have frequently been observed feeding on the fish, more especially during the dry season when their ordinary sources of food supply are limited.

The attempts to establish *Haplochilus lineatus* in nurseries have again proved disappointing, and it is probable that the practical value of this fish will be restricted to those regions in which it is indigenous, and where distribution to confined or temporary breeding places of mosquitoes can be made from natural reservoirs.

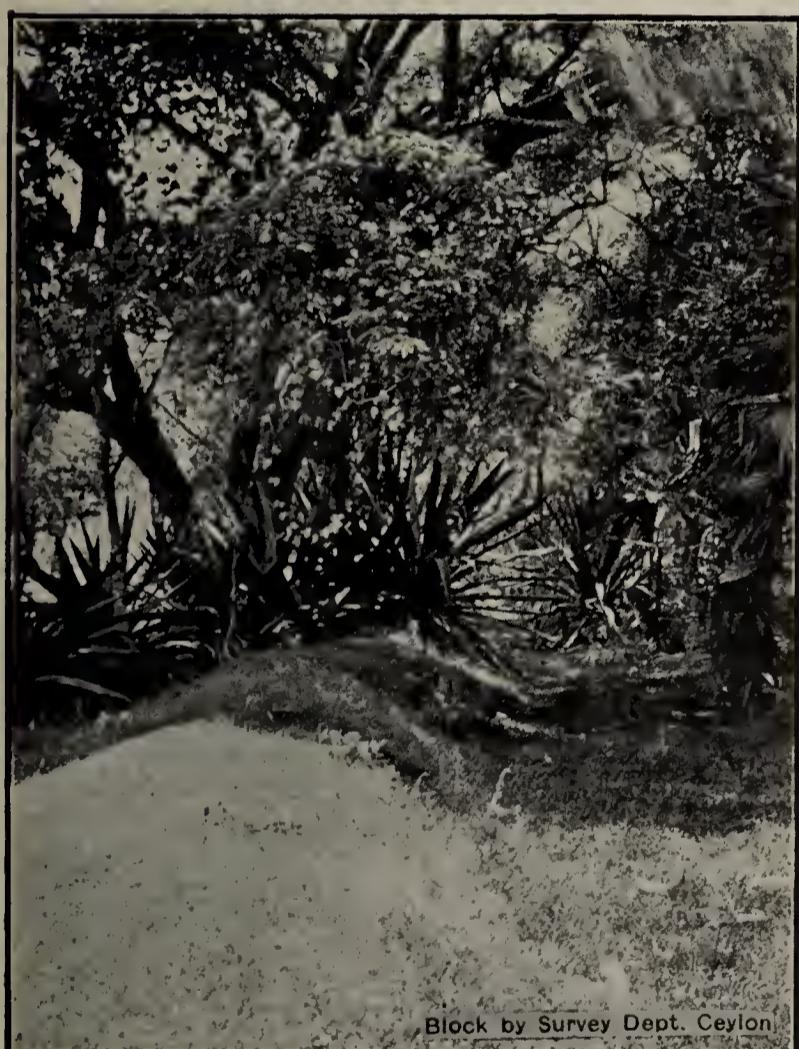
*Malaria Control Measures.*—The anti-malaria campaigns at Anuradhapura, Trincomalee, and Mahara Jail—the latter carried out under the supervision of the prison authorities—have been maintained during the past year. In the cases of the first two campaigns it is too early to attempt any estimation of results at present, especially since the works involved are still incomplete. The campaign at Mahara prison, however, is naturally a much smaller undertaking than those at the towns, and sufficient time has now elapsed to enable a fairly complete report to be submitted. At Trincomalee considerable headway has been made, but it appears probable that certain major works will be necessary in the near future.

The problem of malaria reduction and control at Anuradhapura is vastly more difficult than at either of the other places, owing chiefly to the extensive cultivation of rice by artificial irrigation within the town limits, to physical conditions resulting from past archaeological works, and also to the relatively low degree of sanitation pertaining at the town. Underexisting conditions, paddy cultivation in the Anuradhapura District is without doubt conducive to malaria (see scientific section, page 53) ; and when it is considered that approximately 6 square miles of the town area are devoted to this industry, the magnitude of the problem will be readily appreciated. In fact, it would appear that unless much stricter control of irrigation water can be obtained, and the methods of cultivation (including care of the minor irrigation channels) greatly improved, a definite reduction in the prevalence of the disease will only be attained by prohibiting rice growing in towns and



Block by Survey Dept. Ceylon

1.—Nursery for larvivorous fish, Trincomalee.



Block by Survey Dept. Ceylon



Block by Survey Dept. Ceylon

2 and 3.—Clearance of undergrowth, Anuradhapura ; the same spot before and after clearing.



villages situated in this district. There can be no doubt that the apathy, conservatism, and primitive methods of the cultivators are responsible in no small degree for the association of malaria with this industry; but it is certain that if their close and intelligent co-operation could be obtained the danger arising from the fields would be diminished.

*Anti-Malaria Campaign, Anuradhapura.*—In view of the results obtained from investigations pursued during the preceding year (May, 1922-23) at Anuradhapura it was originally decided to limit anti-malaria measures (commenced in May, 1923) to anti-mosquito works and systematic quinine distribution during the wet season. Other methods of control, such as those directed towards protecting the individual from bites of infected anopheles or of segregating infected persons were rejected as impracticable. The attempt (detailed below) to reduce the numbers of human carriers by quinine administration during the wet season of 1923-24, however, failed owing to the fact that a high percentage of the inhabitants refused to accept the drug regularly.

Anti-mosquito measures were maintained throughout the year on the lines indicated in the previous report, but in addition preliminary work on what may be termed a "major" measure (Halpan-ela) was undertaken. The labour force consisted of approximately 40 convicts under the control of guards, and 5 coolies and a kangany forming an oiling brigade; the work was placed under the immediate supervision of Entomological Assistants G. D. A. Perera and S. L. L. Casiechetty.

Unfortunately it was not possible for a senior member of the staff of this office to be stationed at Anuradhapura, and the direction and supervision of the campaign had to be performed from Colombo. In the latter respect, however, the Chairman of the Local Board has given valuable aid, and had personally inspected the work of the brigades on numerous occasions. The cost of the campaign has so far been borne almost entirely by the local authorities, who voted Rs. 1,500 for the period May-December, 1923, and Rs. 3,000 for the year 1924. Much greater assistance financially would have been necessary, but for the fortunate circumstance of prison labour being available. During January to April the execution of minor initial measures and maintenance works was continued in the central area (sections 1, 2, 3, and 5) of the town. At the end of the latter month preliminary work on the northern portion (section 4) of Halpan-ela was commenced, and was continued until October. Subsequent to October the work included clearing, filling, and drainage measures in sections 5 and 6; and pumping dry, cleaning, and introducing larvivorous fish into wells in the bazaar area.

Oiling as a temporary measure of control of pools and swamps which could not be eliminated or permanently improved at the time was continued throughout the year over an area with radius  $1\frac{1}{2}$  mile from the centre of the town. This area extended considerably beyond that portion of the town where permanent measures were in progress. The work was carried out by the special brigade mentioned above; the coolies were supplied with spraying machines, and applied oil (kerosine 1 part, fuel oil 4 parts) once each week to all recognized breeding places of anopheles.

The work performed during the year may be approximately summarized as follows:—

|   |    |                    |
|---|----|--------------------|
| Extent of jungle and low shrub cleared ..   | .. | 51 acres           |
| Number of pools (including pokunas) cleared and trained ..                        | .. | 80                 |
| Content of pits, swamps, &c., filled ..   | .. | 278,904 cubic feet |
| Content of earth drains and irrigation channels cleared, trained, and regraded .. | .. | 350,842 cubic feet |
| Content of new drains cut ..  | .. | 12,968 cubic feet  |
| Culverts reopened ..  | .. | 26                 |
| Wells cleaned and stocked with larvivorous fish ..                                | .. | 49                 |
| Average number of situations oiled per month—                                     |    |                    |
| Dry season (April to September) ..  | .. | 864                |
| Wet season (October to March) ..  | .. | 1,688              |

As stated in the report for 1923, two important problems—the reconstruction of Halpan-ela and improvement of the general drainage system, and the control of mosquito breeding in wells—remained to be dealt with in the central portion of the town. Some progress in both of these has been made during the past year, and it is hoped that by the end of 1925 the work of Halpan-ela and the introduction of larvivorous fish into wells will be completed. There will yet remain, however, the questions of reorganization and improvement of the general drainage system. During the year the local authorities have constructed several cement drains in the neighbourhood of the bazaar, but such improvements are restricted to a relatively small area, and will have little or no effect on the incidence of the disease generally. It is essential that the entire drainage system be reorganized in order that surface water during the north-east monsoon and leakage or waste from irrigation channels and paddy fields may be removed as rapidly as possible. The utilization of drains as irrigation channels by cultivators should be prohibited. Following a report to the local authorities on the condition of Halpan-ela and its relation to malaria, a conference was held at Anuradhapura on February 13, 1924. Those present were the Government Agent; the Provincial Engineer, North-Central Province; the representative of the Divisional Irrigation Engineer, Northern Division; the Secretary, Local Board; and the Malariaologist. A detailed inspection of the whole course of the ela was made, and it was resolved that a survey (scale, 2 chain to 1 inch) be undertaken and levels determined at an early date. This work was commenced in April and completed in September; it was performed by the Survey and Irrigation Departments respectively. The Divisional Irrigation Engineer then proposed a scheme for reconstruction of the ela and submitted estimates of the cost. There are no apparent difficulties from the engineering point of view, and it is proposed to drain the ela to the river in three tracts by subsidiary channels. With a view to reducing expenditure under this item as much as possible, it has been arranged for the greater part of the work to be performed by prison labour. The work will be commenced in the southern portion of the ela (tract 1) early in 1925, and will be executed under the direction of the Divisional Irrigation Engineer.

Pending the completion of the survey and determination of levels, preliminary work, consisting chiefly of canalization and clearing, was undertaken in the northern portion of the ela (tract 3) from April to October. The stream in this area was in an exceptionally bad state, and it was therefore considered advisable to alleviate the existing conditions as much as possible before the advent of the wet season. This work was carried out over approximately  $1\frac{1}{2}$  miles of the ela, the bed being recut and built to an average width of 13 feet and an average depth of  $2\frac{1}{2}$  feet; nearly 210,000 cubic feet of earth were removed and employed in rebuilding the banks or filling adjoining swamps and low-lying areas. Several new drains (3,650 cubic feet) were cut and connected with the ela.

An additional nursery for larvivorous fish was constructed in April, and was connected by pipes with one of the larger pokunas in order to ensure a constant supply of water. This nursery was protected by fencing and netting and stocked with "Millions"—partly from the original nursery and partly from the nursery at Jaffna.

As indicated above, the fish multiplied rapidly, and approximately 600 were introduced into prepared wells in October and November.

Propaganda work was continued, and several lantern lectures and demonstrations in English and the vernacular languages were given to the public and to school children; a large number of pamphlets and handbills were distributed throughout the town.

The particular objects identified with the administration of quinine at Anuradhapura and the methods adopted to ensure its systematic distribution throughout the town were given in the previous report. The work was under the control of the Provincial Surgeon, North-Central Province, and was maintained from October 17, 1923, to March 31, 1924.

Owing to the high spleen and parasite rates (see previous report) found by random sampling of the inhabitants, it was considered impracticable to restrict quinine administration solely to those in whom definite evidence of malaria infection could be obtained. Such restriction would have involved an enormous number of blood examinations, which could not have been undertaken by this office without the assistance of several trained microscopists. It was decided, therefore, to afford every inhabitant the opportunity of regular treatment during the period in question.

An analysis of the weekly returns made by the apothecaries is as follows:—

*Quinine Distribution, Anuradhapura.*

| Month.       | Visits per House. | Administrations. |               |               |            | Average Number per Person treated. | Quinine Tabloids (Grs. III. and V.) distributed. |
|--------------|-------------------|------------------|---------------|---------------|------------|------------------------------------|--|
|              |                   | Initial.         | Subsequent.   | Total.        |            |                                    |  |
| October      | 2.8               | 2,084            | 1,313         | 3,397         | 1.6        | 5,826                              |  |
| November     | 7.5               | 422              | 3,460         | 3,882         | 1.6        | 6,982                              |  |
| December     | 8.0               | 979              | 2,498         | 3,477         | 1.0        | 6,238                              |  |
| January      | 9.0               | 987              | 3,518         | 4,505         | 1.0        | 7,431                              |  |
| February     | 8.3               | 161              | 3,094         | 3,255         | 0.7        | 4,644                              |  |
| March        | 7.0               | 55               | 2,627         | 2,682         | 0.6        | 3,702                              |  |
| <b>Total</b> | <b>42.6</b>       | <b>4,688</b>     | <b>16,510</b> | <b>21,198</b> | <b>4.5</b> | <b>34,823</b>                      |  |

According to the Census, 1921, the population of the town was 7,781 and the number of dwellings approximately 1,800. During the period of the experiment 42.6, out of a possible 46, visits were made to each house. The results of these visits in relation to actual administration of the drug is shown in the table above. Approximately 60 per cent. (4,688) of the population accepted quinine (bisulphate) at least once during the distribution period, but in spite of the number (42.6) of visits made, the average number of administrations per person treated was only 4.5. During the first two and a half months (to end of December), when owing to climate conditions voluntary acceptance of the drugs was particularly desirable, the results were slightly more favourable; the average number of administrations per person treated being 3.1 in 18.3 visits. The carelessness and lack of interest displayed by the inhabitants generally led to large numbers of the quinine distribution cards being lost, and it is therefore impossible to ascertain exactly what percentage of the population accepted treatment at all regularly. The figure, however, is very low, and even in the best instances the drug was taken at little more than half the visits made.

In view of the statements made above, it is not surprising that so far as has been observed the systematic distribution of quinine at Anuradhapura appears to have effected no appreciable reduction in the parasite rates. The results are not satisfactory, and indicate that even although every facility be given, and the drugs be offered in palatable form, the majority of the people of this district will not accept it voluntarily with sufficient regularity to attain the desired results. In fact, the inhabitants appeared to favour this method of administration merely because, when suffering from the acute stage, it enabled them to obtain treatment without visiting the hospital; and the average townsman was entirely unable to appreciate the use of quinine as a measure of control in the sense previously indicated, and when in apparent health could seldom be prevailed upon to accept it.

*Anti-Malaria Campaign, Trincomalee.*—The staff and labour force employed in connection with this campaign were similar to those of the previous year, the only change of importance being the reversion of Dr. K. J. Rustomjee to Colombo at the end of March, 1924. From this date Dr. W. H. Schokman was in immediate charge of the campaign and connected investigations.

Minor initial anti-mosquito measures were continued on the lines mentioned in the report for 1923, and during the year were confined largely to divisions Nos. 3, 4, 9, and 11. Attention was also paid to compounds, of which 125—situated in divisions Nos. 1, 5, 6, 8, and 9—were cleared and levelled. A large portion of the town has now been treated, and except in the larger and more rural divisions (Nos. 9, 11, and 12), minor measures are almost completed. No work has yet been performed in division No. 12, since, although included within the town, it is situated on the outskirts, at a considerable distance from the inhabited areas, and consists almost entirely of jungle. A considerable amount of work has yet to be done in divisions Nos. 9 and 11, both of which are extensive; and it is probable that major drainage works will be required in each of them in the near future. In division No. 9, recent work in jungle clad areas near dwellings has exposed several extensive borrow pits and pools; those so exposed are being drained, while exploration of similar areas is being undertaken and additional pools found will be kept under observation.

The following summary indicates approximately the extent of new works carried out during the year; it does not include maintenance works, regrading and rebuilding of existing drains, or fillings where material was available in the vicinity and could be transported by hand:—

|   |     |    |                    |
|---|-----|----|--------------------|
| Extent of jungle and low shrub cleared                          | ..  | .. | 27½ acres          |
| Contents of pools filled (150 in number)                        | ..  | .. | 164,714 cubic feet |
| Contents of new drains cut                                      | ..  | .. | 32,850 cubic feet  |
| Wells cleaned and stocked with larvivorous fish (approximately) | 400 |    |                    |

Average number of situations oiled per month—

|                                 |    |    |    |
|---------------------------------|----|----|----|
| Dry season (April to September) | .. | .. | 36 |
| Wet season (October to March)   | .. | .. | 81 |





8.—Borrow pits exposed by jungle clearing, Trincomalee.



9.—Trincomalee horse pond outlet channel after canalization.





Block by Survey Dept. Ceylon



Block by Survey Dept. Ceylon

4 and 5.—Halpan-ela, Anuradhapura : views exemplifying the conditions existing in parts of the stream bed and the nature of the preliminary work performed.



Block by Survey Dept. Ceylon



Block by Survey Dept. Ceylon

6 and 7.—Borrow pits, Trincomalee ; showing method of treatment of the more extensive ones by partial filling and drainage.

In addition, 68 existing channels and drains were canalized and 7,683 small palmyra trees and 1,500 aloes uprooted and burnt. Oiling, as at Anuradhapura, was maintained throughout the year by a special gang of coolies. The main areas in which oiling was done were (1) Admiralty Flats and Maniaveli, where numbers of quarry pits and borrow pits exist; (2) division No. 4; (3) division No. 9, where several pools and marshy areas still exist in the neighbourhood of Brooks' Hill and Sivan Kovil tank; and (4) division No. 11, where many pools and swampy areas occur.

Of the larger and more important works performed, the drainage of the central portion of division No. 4 deserves mention. This area forms an extensive hollow, in which is situated a tank known as the Horse Pond; an outlet channel from the tank runs northwards through division No. 9 to the harbour—a distance of approximately 2,000 feet. In the wet season, owing chiefly to the deplorable condition of this channel, the level of the water in the pond rose considerably and frequently flooded the neighbouring lands; and numerous pools, due to rain and seepage from the surrounding high ground, were also formed. Efficient drainage was essential, since both *A. culicifacies* and *A. funestus* var *listoni* were known to breed freely in this area; but it could only be obtained by reducing the normal level of the water in the tank. The advice of the District Engineer was obtained, and levels were taken on the bed of the channel. As a result, the channel was recut to a uniform width of 3 feet (at bottom), and deepened by an average of 11 inches throughout its length; its course was also straightened as much as possible. This work involved the lowering and rebuilding of a road culvert in division No. 9, a matter which was undertaken by the local authorities. Low-lying areas and pools in the vicinity were then eliminated by filling or draining to the channel.

The nursery for larvivorous fish ("Millions") shown in the photograph was constructed in July, 1924, at a cost of Rs. 30. The fish in the original nursery—a large stone cistern situated in the market place—are thriving, but in view of the large demands made during previous months it was thought advisable to provide a larger, more sheltered, and natural type of reservoir. The new nursery consists merely of a natural pool—the sides of which have been built up—protected by a cadjan fence and roof, and provided with a small spill to prevent overflowing during the wet season. The outlet is guarded by a sheet of perforated zinc. Stocks of fish were introduced from the original nursery at the end of July, and distribution of their progeny was commenced in October. During the last three months of the year the introduction of "Millions" into wells was extensively carried out, rather more than half the total number (795) of wells in the town being so treated, involving the distribution of approximately 4,000 fish.

The chief investigations made during the year in connection with the campaign were (1) additional spleen and blood examinations of large random samples of the inhabitants; (2) monthly examinations (quantitative) of selected breeding places of Anophelines with a view to estimating their numerical and seasonal prevalence; (3) observations on the breeding of Anopheles in the swamps and pits situated in the Admiralty area and at Maniaveli; (4) comparative observations on used and disused wells as breeding places of Anopheles; and (5) an inquiry into the incidence of malaria among the labour force employed on Admiralty works at China Bay.

The spleen and blood examinations were made in June (*i.e.*, immediately after the "fever season") and September by house to house visits and visits to schools. The results for the town and the schools are given separately, the former being shown in tabular form together with those obtained by the examinations made in the previous year:—

*Spleen Rates, Trincomalee, September, 1923-24.*

(Children 12 Years of Age or under.)

| Division No. | September, 1923. |              | June, 1924.      |              | September, 1924. |              |
|--------------|------------------|--------------|------------------|--------------|------------------|--------------|
|              | Number examined. | Spleen Rate. | Number examined. | Spleen Rate. | Number examined. | Spleen Rate. |
| 1            | 105 ..           | 6·6 ..       | 72 ..            | 36·0 ..      | 83 ..            | 15·1 ..      |
| 2            | 200 ..           | 26·0 ..      | 67 ..            | 49·2 ..      | — ..             | — ..         |
| 3            | 112 ..           | 19·6 ..      | 75 ..            | 45·3 ..      | 86 ..            | 13·9 ..      |
| 4            | 80 ..            | 13·5 ..      | 22 ..            | 59·1 ..      | 68 ..            | 19·1 ..      |
| 5            | 140 ..           | 15·0 ..      | 29 ..            | 41·4 ..      | 78 ..            | 21·8 ..      |
| 6            | 139 ..           | 7·1 ..       | 23 ..            | 30·4 ..      | 84 ..            | 20·2 ..      |
| 7            | 87 ..            | 6·8 ..       | — ..             | — ..         | 39 ..            | 5·1 ..       |
| 8            | 96 ..            | 9·3 ..       | — ..             | — ..         | — ..             | — ..         |
| 9            | 96 ..            | 10·4 ..      | 43 ..            | 58·1 ..      | 81 ..            | 24·6 ..      |
| 10           | 119 ..           | 10·0 ..      | — ..             | — ..         | 75 ..            | 6·6 ..       |
| 11           | 94 ..            | 15·9 ..      | — ..             | — ..         | — ..             | — ..         |
| 12           | 63 ..            | 15·8 ..      | — ..             | — ..         | — ..             | — ..         |
| Town ..      | 1,331            | 14·1         | 331              | 45·7         | 594              | 16·4         |

In June, 1924, also, 391 children attending schools in the town were examined, and spleen rates ranging from 25·0 to 95·6 with an average of 43·9 were obtained; while in September of the previous year an average rate of 13·7 (range 5·3 to 38·2) was found among 648 children examined at the same schools.

The average rate (town and school children combined 44·7) in June, 1924, is thus even higher than that recorded at the conclusion of the severe epidemic of 1923, when in June of that year enlarged spleens were found in 37·6 per cent. of the children examined. The discrepancy, however, is not great, and may perhaps be due to less extensive sampling (178 children only examined) in the latter case. Nevertheless, the hospital records of cases treated for malaria during the "fever season" of 1924 were considerably less than those of the corresponding period of 1923:—

*Malaria Cases treated at Trincomalee Hospital, March to July, 1924.*

| Month.   | 1923.    | 1924. |
|----------|----------|-------|
| March .. | 895 ..   | 423   |
| April .. | 1,494 .. | 743   |
| May ..   | 670 ..   | 636   |
| June ..  | 431 ..   | 370   |
| July ..  | 264 ..   | 242   |
| Total .. | 3,754    | 2,414 |

There being no evidence to indicate that cases from the neighbouring districts treated at the hospital exhibited any definite percentage decrease, it would appear probable that the reduction in the number of cases treated for malaria derived from the town area is due mainly to two factors. First, the suddenness and severity of the outbreak of 1923, after a period of comparative freedom from such epidemics, rendered the inhabitants nervous as to the nature of the disease, and caused those affected to visit the hospital without delay; and second, that during the year following this epidemic cases of a mild nature due to residual infections occurred, but did not attend hospital for treatment.

It is difficult to explain satisfactorily the great, but more or less uniform, discrepancies existing between the rates recorded in June and September, 1923, and June and September, 1924. The higher rates obtained in June of each year may perhaps be due mainly to the fact that at the times of examination the annual epidemic periods had barely concluded, and, therefore, many slightly enlarged spleens, which would have become non-palpable by September, would have still been apparent. Calculations based on the splenic values (see page 55) derived from the percentage distribution of spleens of various sizes composing the spleen rates suggest, however, that this explanation is not sufficient to account entirely for the differences observed, and indicate that the rates observed in September, 1923 and 1924, are somewhat too low. The calculated rates for the September series are 18.9 (1923) and 19.6 (1924). Blood films were taken during the spleen examination in June from both children and adults (i.e., persons over 12 years of age); the main results were as follows:—

*Parasite Rates, Trincomalee, June, 1924.*

|         | Children.        |                  |                |                  | Adults.          |                |  |  |
|---------|------------------|------------------|----------------|------------------|------------------|----------------|--|--|
|         | Number examined. | Number positive. | Parasite Rate. | Number examined. | Number positive. | Parasite Rate. |  |  |
| Schools | .. 228 ..        | 38 ..            | 16.2 ..        | 166 ..           | 22 ..            | 13.3 ..        |  |  |
| Town    | .. 246 ..        | 31 ..            | 12.6 ..        | 480 ..           | 41 ..            | 8.5 ..         |  |  |
| Total   | .. 474 ..        | 69 ..            | 14.6 ..        | 646 ..           | 63 ..            | 9.7 ..         |  |  |

Of the total films (132) in which malaria parasites were observed, *P. vivax* (benign tertian malaria) occurred in 74.3 per cent., *P. malariae* (quartan malaria) in 18.2 per cent., and *P. falciparum* (subtertian or malignant malaria) in 7.5 per cent. The parasite of quartan malaria was more frequently observed in children (23.1 per cent.) than in adults (12.6 per cent.), while that of subtertian malaria occurred more often in the latter (children 5.7 per cent., adults 9.5 per cent.). The average parasite rate (14.6) in children was higher than that (9.7) found in September of the previous year, when 224 films were examined.

The quantitative investigations undertaken with a view to estimating the prevalence of anopheles referred to above are not yet completed. They were restricted largely to the larval stage of the various species concerned, since it is contended that the closer limitations of the larval environment and greater uniformity in larval habits ensure stricter accuracy of measurement than can be obtained by work with adult mosquitoes. The work was continued throughout the greater part of the year, and included the careful examination each month of various types of potential breeding places situated within the town.

Observations on the breeding of anopheles in the Admiralty area and Maniaveli were performed in January and from March to October. These areas adjoin the southern limits of the town and are extensive; they include a relatively large open marshy tract and higher lands thickly covered with scrub jungle, in which are situated numerous abandoned quarry and borrow pits. The low-lying ground in the Admiralty area contains a large number of potential breeding places of Anopheles, but is to some extent subjected to tidal flushing; the water is usually salt or brackish, but during the rains becomes sufficiently diluted in certain situations to support the larvæ of several species. Forty situations of various types were selected for examination in this area throughout the period mentioned. In January and March the Anopheles found in order of larval prevalence were *A. subpictus (rossi)*, *A. funestus* var *listoni*, *A. culicifacies*, *A. barbirostris*, and *A. hyrcanus*, but at no time were larvæ very numerous. From April onwards the number of water collections rapidly diminished, and the degree of salinity in many of those remaining increased considerably. No larvæ of Anopheles were found during the period April to October.

It would appear that less danger is to be apprehended from the actual water-logged area than from the Maniaveli quarry pits, some of which are situated within a quarter mile of Admiralty House. These pits provide very favourable breeding places for Anophelines, being protected by a thick belt of low jungle and capable of retaining water for long periods. Examinations made from April to August, when most of the pits contained water, showed that prolific breeding occurred in this area, and that larvæ of *A. funestus* var *listoni*, *A. subpictus*, and *A. culicifacies* were most prevalent. Upwards of 40 of these pits have at present been located, and fresh ones are still being formed. They are situated sufficiently near the town, however, to constitute a source of danger, and their elimination will be necessary; at present no permanent measures have been introduced in this area, control being maintained by systematic oiling.

The importance of wells as breeding places of Anophelines at Trincomalee was indicated in the previous report. Nearly 800 wells are present in the town, and of these approximately 80 per cent. are constructed of stone and cement and provided with parapets. They vary considerably in depth, but many (about 40 per cent.) dry out or contain little water during the last two or three months of the hot season; in the latter condition they are not used, the water supplies being obtained from such wells as remain serviceable. Comparative observations on used and disused wells were commenced in July and continued throughout the remaining months of the dry season. Forty used and thirty disused wells which had not been stocked with larvivorous fish were selected for examination:—

*Breeding of Anopheles in Wells, Trincomalee.*

Larval Rate per 100 Samples.

| Number of Examinations. | Larvæ present. Per Cent. | Larval Rate per 100 Samples. |                     |                          |
|-------------------------|--------------------------|------------------------------|---------------------|--------------------------|
|                         |                          | All Species.                 | <i>A. listoni</i> . | <i>A. culicifacies</i> . |
| Used                    | .. 160 ..                | 14.4 ..                      | 8.1 ..              | 6.8 ..                   |
| Disused                 | .. 117 ..                | 26.5 ..                      | 31.8 ..             | 23.4 ..                  |

The main results are given in the above table; they show that not only were Anopheles larvæ found almost twice as often in wells which were temporarily disused, but that the larvæ were far more abundant in such wells. *A. funestus* var *listoni* was the predominant species, but *A. culicifacies*, *A. subpictus*, *A. jamesi*, *A. fuliginosus*, and *A. hyrcanus* also occurred; the three last named Anopheles were, however, only found in disused wells.

The control of mosquito breeding in wells at Trincomalee, as in many other towns in the Island, is a problem of considerable importance and magnitude in relation to malaria reduction. The larvæ of dangerous malaria-carrying species, such as *A. funestus* var *listoni*, *A. culicifacies*, and, in the hill-country, *A. maculatus*, are commonly found in them; and in the dry zone they act as permanent larval reservoirs during the

pre-monsoon period, when conditions are distinctly adverse to mosquito propagation. Until such time as pipe-borne water supplies can be introduced, it would appear that the most promising, and certainly the most economical, measure of control will be by means of the larvivorous fish " Millions." The treatment of wells by other methods, such as sealing and instituting pumps, screening, or oiling, appears to be impracticable either on grounds of expense or because such methods would lead to opposition or incorrect usage on the part of the public. There can be little doubt, however, that the number of wells present in most towns is excessive, and that many could be abolished without detriment to the inhabitants. Rigorous restrictions must be placed upon the construction of private wells in towns, and all such wells not in constant use should be condemned and closed by the owner without delay. The formation of unbuilt or " earth " wells—no matter for what purpose they are designed—should be prohibited, and those at present existing should everywhere be eliminated. The strict enforcement of such measures in conjunction with the extended use of fish would go far towards solving the problem.

The inquiry into the incidence of malaria among the coolies employed on the Admiralty works at China Bay was instituted chiefly with a view to determining the possibilities of malaria importation from the camp during the north-east monsoon period. The site of the works is situated approximately 10 miles by road from Trincomalee in a severely malarious district. At the time of the investigation work had been in progress for some months, and over 1,000 men were employed. Of these, however, approximately 400 only lived on the site, the remainder being recruited mainly from Trincomalee and the surrounding villages. Large numbers of the latter class returned to their homes each evening, thus ensuring close connection between the camp and the town. Spleen and blood examinations of samples of the resident coolies were made in October; 56 of 362 (15.5 per cent.) coolies showed splenic enlargement, and 6 of 158 (3.7 per cent.) malaria parasites in the blood. The spleen rates ranged in the different classes of men from 0 to 33.3 per cent., but it should be noted that the examinations were made at the end of the dry season, and that the majority of those examined had only been present in the camp for a period of two or three months. At this time mosquitoes of all kinds were very scanty, and their breeding places reduced to a minimum. The results, however, indicated that the composition of the resident labour force in regard to malaria infection was of a varied nature, and that considerable numbers of susceptible coolies were present. This fact when associated with conditions existing at the camp and its immediate vicinity could only be regarded as favourable to the production of an epidemic at some future date, when a more or less severe reaction upon the town might be expected. Recommendations were, therefore, made to the authorities, who instituted precautionary measures within their area.

*Anti-Malaria Campaign, Mahara Prison.*—As stated in the report for 1922, malaria control measures were instituted at Mahara towards the end of that year, following a severe epidemic among the prisoners and staff during June to October. The measures recommended were carried out by the Prison authorities, and by the Harbour Engineer's and Public Works Departments in the areas under their administrations.

The prison is situated in the Western Province a few miles north-east of Colombo; it has been in existence for several years, but originally was not built with a view to permanency. Many of the buildings are of a purely temporary character, consisting of mud and wattle walls and cadjan roofs; they are poor and ill-ventilated, and in many cases form most attractive types of shelters—for resting and feeding purposes—for mosquitoes. Since 1915 the establishment has consisted of two jails, the old jail and the portable jail, the latter having been transported from Mankulam (in the Northern Province), and re-erected in the quarry included within the prison area. The water supply is pipe-borne, being pumped from reservoirs at Ragama. Two quarries, from which metal for the harbour and roads is obtained by convict labour, are closely associated with the prison; the larger and more important is that referred to above, the smaller is situated outside the jail premises, at a distance of approximately 200 yards from the portable jail. The lands surrounding the prison are for the most part under cultivation, consisting of coconut plantations, paddy fields, and native gardens. The climate is hot and moist, similar to that of Colombo, the annual average rainfall is slightly over 90 inches, the wettest months being April to June and September to November, at the onset of the southwest and north-east monsoons respectively.

Although the prison is situated in a district of low malarial endemicity, it has for years past maintained an unenviable reputation in regard to the prevalence of malaria. The annual reports for recent years of the resident medical officers contain particular reference to this disease, the increased severity of which it is maintained dates from the establishment of the portable jail. Attempts to control the disease were made in 1915, 1916, 1918, and 1919, but the measures adopted (quinine prophylaxis and occasional oiling of pools), although affording a temporary measure of relief, were not such as to confer permanent improvement.

Investigations made with a view to instituting a definite campaign against malaria were commenced during the epidemic in September, 1922. At this time very numerous cases were applying daily for treatment, and hospital accommodation was possible only by the conversion of prisoners' wards. The epidemic was by no means confined to the convicts, and members of the staff and their families resident at, or in the immediate vicinity of, the jail also suffered severely.

The following table gives the results obtained from examinations of random samples of apparently healthy children resident at the prison and in the surrounding districts:—

*Malaria at Mahara Prison and in the Surrounding Districts.*

| Locality.  | Date.           | Number of Children examined. | Spleen Rate. | Number of Blood Films examined. | Parasite Rate. |
|--|-----------------|------------------------------|--------------|---------------------------------|----------------|
|  |                 | Per Cent.                    |              | Per Cent.                       |                |
| Mahara prison school ..                          | September, 1922 | .. 30 ..                     | 90.0 ..      | 22 ..                           | 40.9           |
| Area, radius $\frac{1}{4}$ to 1 mile of jail ..  | September, 1922 | .. 347 ..                    | 1.5 ..       | — ..                            | —              |
| Area, radius $\frac{1}{4}$ to 3 miles of jail .. | October, 1921   | .. 1,218 ..                  | 2.5 ..       | 80 ..                           | 2.5            |
| Area, radius 3 to 6 miles of jail ..             | October, 1921   | .. 2,785 ..                  | 1.4 ..       | 444 ..                          | 3.3            |

The rates given, however, are not strictly comparable owing to the epidemic at the prison, and to the examinations being made in two different periods. Those for the prison school are undoubtedly above normal, but those for the neighbouring districts would appear to be representative, and show that the epidemic was confined to a small and sharply limited area.

Similar examinations of the convicts and staff gave the following results:—Convicts: (1921) spleen rate 10.6, parasite rate 1.5, (1922) spleen rate 25.2, parasite rate 32.5; Staff: (1922) spleen rate 47.5, parasite rate 14.3.

The forms of malaria present at the time of the epidemic, and their relative prevalence as determined from films (31) in which parasites were observed, were: benign tertian (*P. vivax*) 51.5 per cent., subtertian or malignant (*P. falciparum*) 48.5 per cent. No parasites of quartan malaria were seen. Subtertian malaria was distinctly more prevalent than has been observed elsewhere, extended investigations having shown it to be responsible for an average of approximately 10 per cent. only of malarial infections.

A mosquito survey of the jail and its immediate neighbourhood showed that breeding places of several species of *Anopheles* were present. Adult *Anopheles*, however, were not abundant at any time during the investigation, and although careful search was made in the early mornings and evenings, very few specimens were obtained. Dissections of the latter, made with a view to definitely incriminating the active malaria-carrying species, gave negative results. Larvae or adults of the following species were found in the course of the survey : *A. barbirostris*, *A. culicifacies*, *A. fuliginosus*, *A. funestus* var *listoni*, *A. hyrcanus*, *A. jamesi*, *A. subpictus*, and *A. subpictus* var *vagus*. Breeding places of all these Anophelines were found both within the prison premises and in the surrounding neighbourhood, but those of *A. culicifacies* and *A. listoni* were much more numerous in the former area. This was particularly the case with *A. culicifacies*, the larvae of which were found to a very limited extent outside the jail boundaries. In this connection it is of interest to note that both *A. culicifacies* and *A. listoni* are relatively uncommon in the district generally, and that the former—which becomes much more plentiful in the drier districts further north—appears to be very restricted or local in its distribution in this region. The remaining species of *Anopheles*, with the exception of *A. fuliginosus*, which was found in only one situation (within the quarry), appeared to be plentiful, their larvae being numerous in adjoining paddy fields, road drains overgrown with vegetation, coconut trenches, &c. The results of the survey appeared to indicate that anti-mosquito measures could be largely confined to the jail premises and the quarries, and that except in one area little was required elsewhere. The chief breeding places of the two important species mentioned above were (1) the ella and quarry drains; (2) wells and bathing pools; (3) small pools in the irregular surface at the foot of the working face of the quarry; and (4) newly formed trenches in the coconut plantation adjoining the southern boundary of the prison. The stream or ella flowed along the eastern boundary of the prison and passed within a few yards of the portable jail; the bed was in places composed of rock, contained numerous pot holes, and at intervals was partially blocked by masses of stone and weeds, or considerably narrowed by infringement of the banks; in many places also the sides were built of pieces of rock, the interstices between which formed excellent larval shelters. The quarry drains were badly graded, and, except during heavy rain, contained many small pools; they were in poor condition, and were insufficient to eliminate seepage water from the face of the quarry. It was, moreover, a common practice of the convicts to construct temporary dams in these drains in order to form pools in which to perform their ablutions, and to soak their baskets preparatory to repair. Wells and bathing pools were very numerous, particularly within the quarries; these pools, which were shallow and faced with pieces of rock, provided very favourable breeding places for *A. culicifacies*.

The pools at the foot of the working face of the quarry were prolific breeding places of both *A. culicifacies* and *A. subpictus*. As the face of the quarry receded, the irregular surface at its base produced by blasting and other operations was filled and levelled, but such measures could not be carried out in the actual working area, and therefore numerous small pools were invariably present. Larvae of *A. culicifacies* and *A. subpictus* were abundant in the newly cut trenches in the adjoining coconut estate, these being the only breeding places of the former species found outside the quarries; old trenches overgrown with vegetation were present in considerable numbers in the surrounding neighbourhood, but many were used for soakage purposes and were negative, while those in which the water was not polluted were only found to harbour larvae of *A. barbirostris*, *A. hyrcanus*, *A. jamesi*, and occasionally *A. subpictus*.

The results of these investigations indicated that the main factors responsible for the severe incidence of malaria at the prison and its almost complete restriction to so limited an area were—

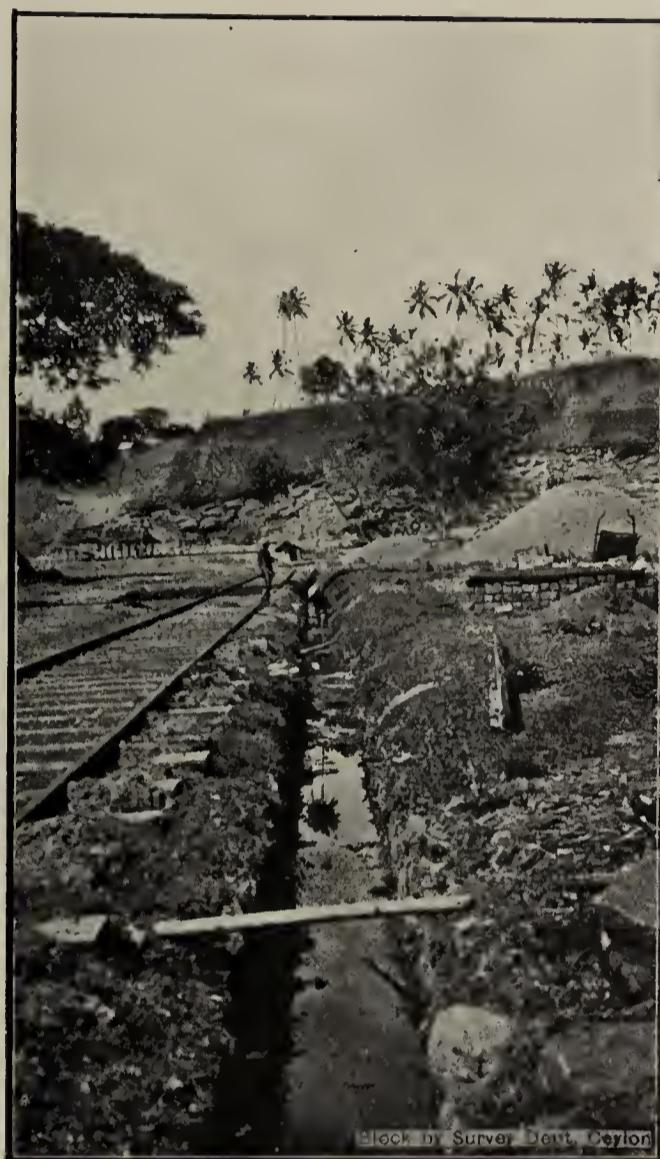
- (1) The continued presence and close association of a large body of convicts drawn from all parts of the Island, and invariably including a number of infected persons.\*
- (2) The presence in the immediate vicinity of numerous collections of water favourable as breeding places of two efficient insect carriers of the disease—*A. culicifacies* and *A. funestus* var *listoni*—and the relative scarcity of these two Anophelines, particularly the former, elsewhere.
- (3) The presence of an abundant food supply—the blood of persons living in the jail—for the Anopheline mosquitoes close to their chief breeding places, and the relatively sparse population and scattered distribution of dwellings in the surrounding districts.

A report with recommendations for control and prevention was submitted to Government at the end of September, 1922, and was shortly followed by a detailed inspection of the prison area. The officers present at the inspection included the Principal Civil Medical Officer, the Director of Public Works, the Inspector-General of Prisons, the Sanitary Commissioner, the Deputy Harbour Engineer, and the Malariaologist. As a result of this inspection a report, supporting and in certain instances extending the recommendations previously made by the Malariaologist, was forwarded to Government.

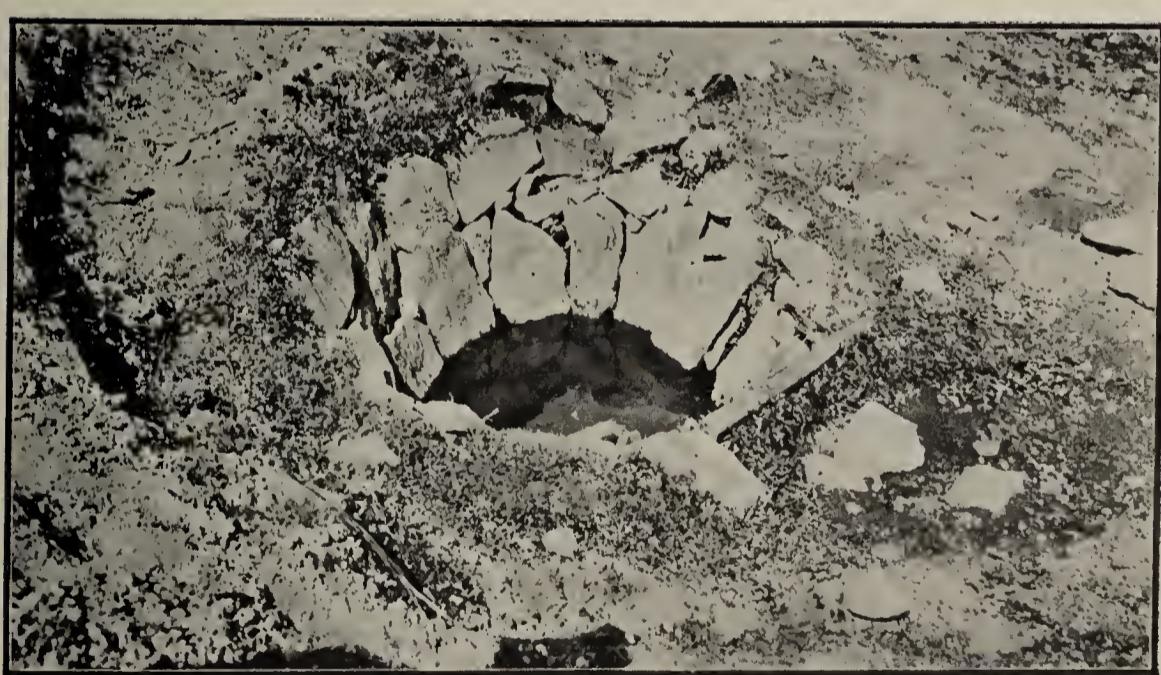
In view of the results of the investigations, and of the difficulty of determining to what extent it would be possible to deal effectively with breeding places of *Anopheles* on private lands in the vicinity of the jail, it was considered advisable to await the effects of anti-malaria measures in the prison area before attempting any works outside that area. The measures recommended were, therefore, largely restricted to the jail premises and the adjoining quarries; they may be summarized as follows :—

- (1) *Improvement of Buildings.*—Structural alterations and additions to the staff quarters, or preferably the erection of entirely new quarters of a superior type sufficient to house the entire staff and prevent any of the subordinate officers having recourse to existing miserable dwellings in the near vicinity.
- The extension and improvement of the hospital accommodation for both the staff and the convicts, including the provision of mosquito-proof wards for acute cases, and the erection of two additional wards of 50 beds each for convalescent cases. Alternatively, in view of the expense connected with such improvements, it was recommended that the building of the proposed new prison at Ragama be commenced with the least possible delay.
- (2) *Quinine Administration.*—Arrangements to be made by the Prison authorities for the compulsory curative and preventive treatment of prisoners and members of the staff and their families, especially with a view to sterilizing existing human carriers and reducing the number of relapses and new infections. Such treatment to be applied also to all new arrivals at the prison in whom evidence or history of infection with malaria was obtained. These measures to be continued until anti-mosquito measures were completed, or until such time as it was considered advisable to modify or suspend them.
- (3) *Transference of Staff.*—The transference to non-malarious stations of all officers—particularly if married—in whom symptoms of malarial cachexia or severe malarial infection were present, after they, and if necessary their families, had undergone the above treatment for a period of not less than one month.
- (4) *Reduction of Labour.*—The daily task of all prisoners engaged on work in the quarries, and undergoing the above treatment, to be reduced until such treatment was completed.
- (5) *Anti-Mosquito Work.*—The inauguration of suitable measures directed primarily against the species *A. culicifacies* and *A. funestus* var *listoni*, to reduce the number of their breeding places or to render such places unfavourable for breeding purposes.

\* The Resident Medical Officer reports that of 847 prisoners admitted to the jail in 1924, 595 (70.2 per cent.) had a previous history of malaria.



Block B, Survey Dept., Ceylon

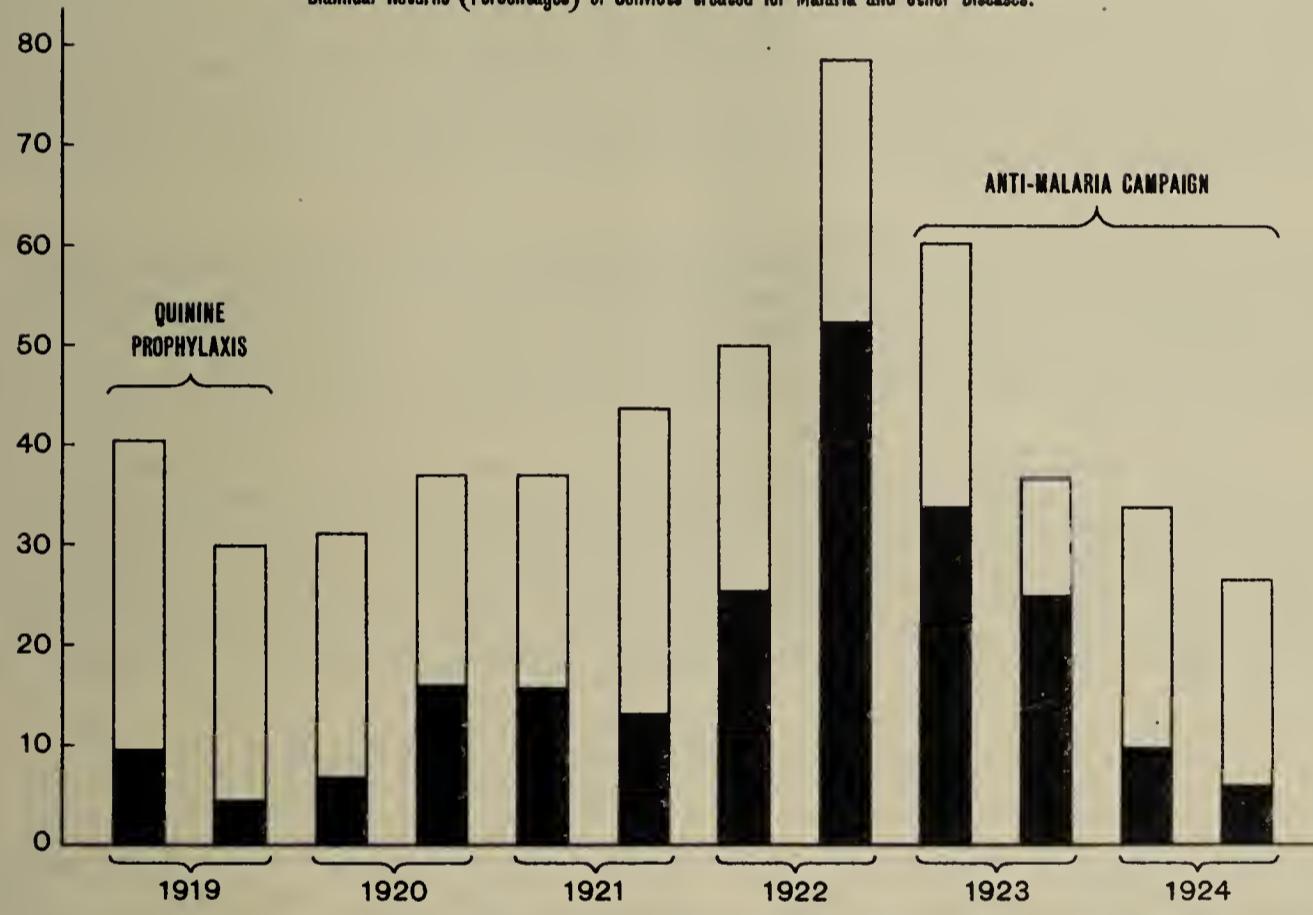


10 and 11.—Mahara Prison. The main quarry drain and one of the numerous bathing pools constructed by the convicts; breeding places of *A. culicifacies* and *A. funestus* var. *listoni*.



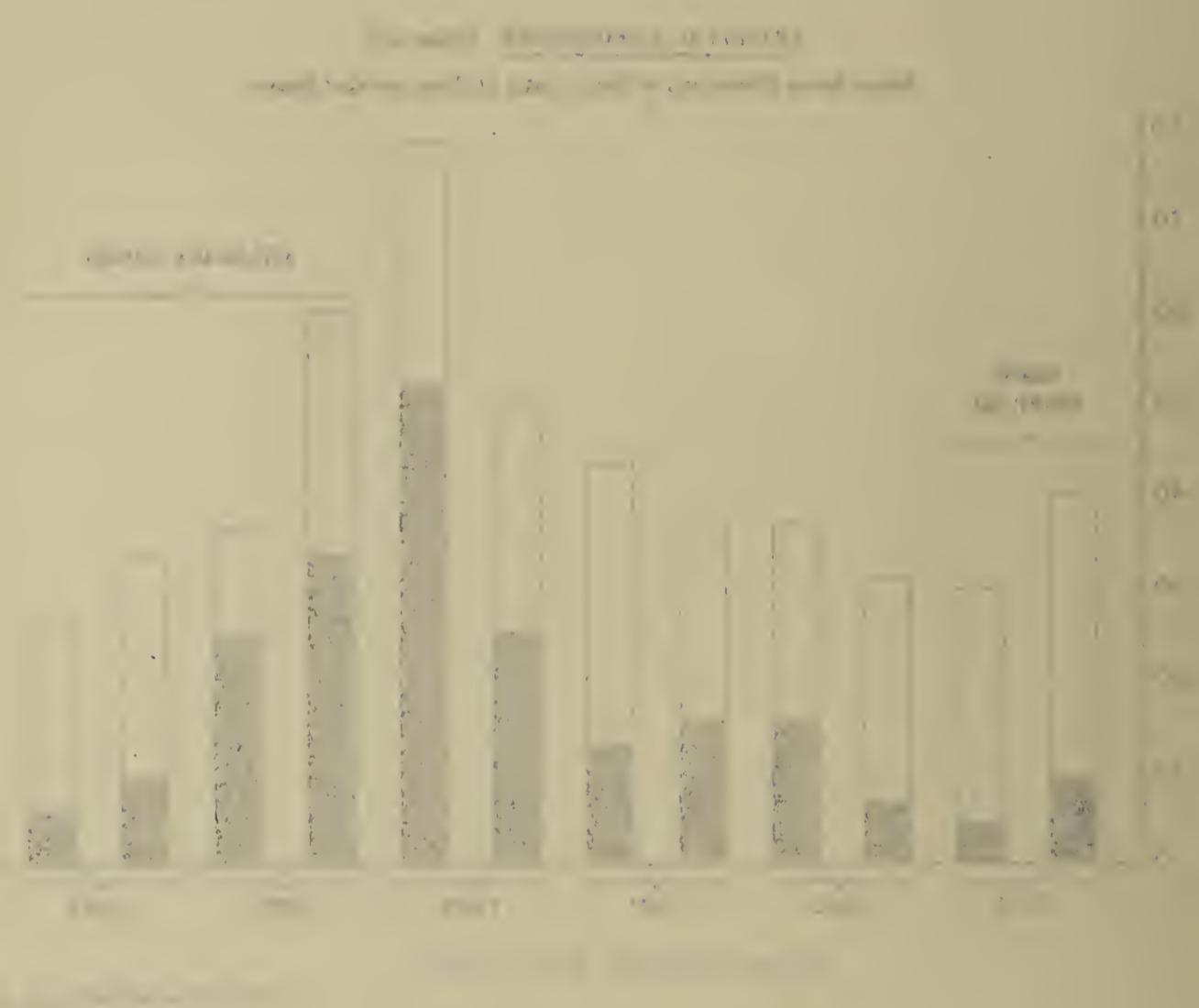
### HOSPITAL ADMISSIONS (Mahara Jail)

Biannual Returns (Percentages) of Convicts treated for Malaria and other Diseases.



Malaria Morbidity, Mahara Prison.

Printed, Survey Dept: Ceylon. 15 - 9 - 25.



The measures proposed under heads (2) to (5) above were instituted without delay. The systematic administration of quinine was under the control of the Resident Medical Officer, and anti-mosquito works were carried out by gangs of prisoners under the direction and supervision of the Harbour Engineer's and Public Works Departments.

All superfluous bathing pools and wells were immediately closed, and those remaining stocked with larvivorous fish. These fish were also introduced into a rock-built tank—in which Culicine larvæ was abundant—with a view to forming a nursery and ensuring future supplies. The general drainage system of the main quarry was much improved, and existing drains were regraded and lined with cement; the practice of damming these channels was prohibited, and all pools formed in this way eliminated. Depressions containing, or liable to contain, water at the base of the working face of the quarry were temporarily filled with sand or oiled once each week. Improvement of the bed of the stream mentioned above presented the chief obstacle in connection with anti-mosquito measures. It was originally recommended that the bed be recut throughout its course in the jail premises and for a distance of one-half mile on each side of the boundaries. This, however, was not considered feasible in its entirety, and less laborious and expensive measures were provisionally adopted. Briefly, the stream was rebuilt and regraded everywhere, except in those portions of its lower course where such work entailed cutting through solid rock; the banks were constructed of pieces of rock, and all interstices filled with cement to a height of several inches above the level of the water. A dam provided with a sluice was then erected a short distance above the rock-bound situations in order that every few days, when sufficient head of water had accumulated in the upper portion of the stream, strong flushing could be obtained. Repeated observations made subsequent to the erection of the dam indicated that this method of treating the stream was satisfactory, provided the sides and channel were kept free from weeds and débris. Indigenous larvivorous fish (*Haplochilus lineatus* and *Rasbora daniconius*) were numerous, and in the area above the dam—where prior to flushing an unbroken sheet of water existed—were able to exert their beneficial action to its fullest extent. Examinations made both above and below the dam showed that under these conditions *Anopheles* larvæ were extremely scanty, and on several occasions none was found within approximately 200 yards of the boundaries.

In addition to the anti-mosquito measures outlined above, a permanent brigade (consisting of 10 to 12 convicts) was formed for maintaining such measures in good condition. The duties of this brigade, which was under the control of the Prison Superintendent, included the regular clearing, flushing, and, if necessary, repair of the ella and quarry drains, the temporary filling and weekly oiling of pools near the face of the quarry, the removal of rank and low-growing vegetation, the collection and disposal of old tins, coconut husks, &c., and similar works. This party also extended their activities to the care of drains on private lands adjoining the prison.

Larvivorous fish were introduced into the coconut trenches mentioned above, but no further action was possible. These trenches are now overgrown with vegetation, and larvæ of *A. culicifacies* have not been found in them for more than one year. At an early date, however, this plantation was thoroughly cleared and numerous pits and holes obliterated. This was done mainly as a demonstration to the neighbouring landowners to indicate the lines on which co-operation was required. Propaganda work was performed and breeding places of *Anophelcs* demonstrated, but although considerable interest was shown at the time, little or no response to the appeals has been made.

The beneficial effects of the campaign may best be appreciated by an examination of the following tables and the chart showing the returns of the prison hospital during the past six years. In this connection, however, it is important to note that in 1923 and 1924 all cases of malaria, including those of a very mild nature, were admitted for treatment, whereas in the previous years lack of accommodation necessitated the exclusion from hospital of the less severe cases. Such cases, although treated, were not entered in the registers, and therefore the figures of the period 1919 to 1922 are not truly representative, or strictly comparable with those of 1923 and 1924. Actually it is probable that the facts are more accurately represented by the malarial death rates.

*Mahara Prison Hospital Returns, 1919-1924.*

General.

Malaria.

| Year. | Average Daily Strength of Jail. | Total Cases treated. | Average Daily Sick. | Death Rate. |           | Cases treated. | Death Rate. | Primary Infections. | Relapses. |
|-------|---------------------------------|----------------------|---------------------|-------------|-----------|----------------|-------------|---------------------|-----------|
|       |                                 |                      |                     | Per Cent.   | Per Cent. |                |             |                     |           |
| 1919  | 1,031.4                         | 4,421                | 10.9                | 10.7        | ..        | 800            | 1.0         | ..                  | ..        |
| 1920  | 1,085.1                         | 4,495                | 8.6                 | 3.3         | ..        | 1,462          | 1.2         | ..                  | ..        |
| 1921  | 1,102.6                         | 5,265                | 9.8                 | 8.2         | ..        | 1,711          | 2.4         | ..                  | ..        |
| 1922  | 796.9                           | 5,767                | 11.9                | 4.4         | ..        | 3,377          | 2.5         | ..                  | ..        |
| 1923  | 671.8                           | 4,002                | 10.2                | 1.3         | ..        | 2,032          | 0.3         | 326                 | 1,707     |
| 1924  | 740.1                           | 2,740                | 8.3                 | 1.2         | ..        | 712            | 0.1         | 156                 | 556       |

This chart shows graphically the number of cases (as percentages of the average daily strength of the jail) treated at the hospital every six months since January, 1919. The height of the column represents the total admissions (all diseases), and the blackened portion admissions for malaria. In comparing the latter, the statements made above must be given due weight, but the regular and definite decrease of the disease throughout the campaign period is very evident. The effect of the campaign upon the general health of the prisoners is also indicated, and it will be observed that the total admissions during the latter half of 1924 are definitely less than for any similar period during the years under review.

*Mahara Prison Spleen Rates, 1921-1924.*

Children.

Convicts.

| Date.           | Number examined. | Rate. | Number examined. | Rate. |
|-----------------|------------------|-------|------------------|-------|
|                 |                  |       |                  |       |
| October, 1921   | —                | ..    | —                | 10.6  |
| September, 1922 | 30               | 90.0  | 99               | 25.2  |
| August, 1924    | 49               | 12.2  | 201              | 7.0   |

In connection with the spleen rates given above, it may be noted that of the children (49) examined in 1924, 30 had resided at the prison for a period of over one year; the rate for this group alone was 16.6 per cent. Similarly, 101 of the convicts examined had also passed more than one year at the jail, the rate being 8.9 per cent. During 1924 also the Resident Medical Officer (Dr. W. Wickremesinghe), to whose energy and ability,

much of the success attending the campaign is due, examined a large number of convicts for splenic enlargement. These examinations were made at various times throughout the year, and included most of the long service men ; of 803 prisoners examined in this way, enlarged spleens were detected in 119 or 14.8 per cent.

*Reports.*—During the year the following reports—some of which necessitated additional investigatory work—were submitted to Government :—

- (1) Annual report for the year 1923.
- (2) Malaria in the Kalmunai district, Eastern Province.
- (3) Progress report on the anti-malaria campaign at Anuradhapura.
- (4) Malaria at Mullaittivu, Northern Province.
- (5) Malaria and “ Kataragama fever ” at Kataragama, Province of Uva.

13. *Cholera.*—Seventeen cases of cholera with 14 deaths were reported during the year. Of these, 1 occurred in Colombo town, 1 in the port of Colombo, 1 in the North-Western Province, 4 in the Central Province, 1 in Sabaragamuwa, and 9 in Uva, where there was an outbreak in 1919–20. There were no cases during 1921, 1922, and 1923.

14. *Smallpox.*—There were 45 cases with 9 deaths, as against 240 cases with 35 deaths the previous year and 337 cases with 43 deaths in 1922. Of the cases reported during the year, 4 cases were landed in Colombo from steamers, 4 cases occurred in Colombo town, 8 cases were admitted to the Infectious Diseases Hospital, Colombo, from the neighbouring villages, 1 occurred in the North-Western Province, 1 in Sabaragamuwa, 1 in the Central Province, and 26 cases with 5 deaths in the Northern Province, where there was an epidemic in the Jaffna Peninsula in the last quarter of the year.

15. *Vaccinations.*—The total number of primary vaccinations performed during the year was 128,591, of these 123,009 were successful and 2,775 were failures. In 8,465 cases the results were not determined.

The percentage of successful primary vaccinations was 97.81 per cent. in 1924, 98.52 per cent. in 1923, and 93.7 per cent. in 1922. Vaccination is carried on throughout the year by trained male and female vaccinators, the former vaccinate in the towns and villages and estates periodically according to annual programmes of vaccination, and the latter itinerate in the towns and villages to vaccinate Muslim women and children.

16. *Government Vaccine Establishment.*—The officer in charge reports 482 calves were received on hire from the contractor ; 472 calves were used for vaccination during the year, and of these 456 were returned to the contractor. Seed lymph for the vaccination of calves was obtained from the Lister Institute of Preventive Medicine, London, and from the King Institute, Madras, and was also prepared locally. 143,145 tubes of calf lymph were issued from this establishment during the year. Of these, 1,129 tubes were sold and realized a sum of Rs. 1,078, 775 tubes were issued to the Colombo Municipality, and the balance to the vaccinators of the Department.

A large quantity of lymph is stored in bulk as a reserve supply for issue during epidemics of smallpox.

98.79 per cent. of primary vaccinations with calf lymph issued during the year were successful.

17. *Enteric Fever.*—The total number of cases treated in Government hospitals during the year was 1,600 with a death rate of 25.5 per cent., as against 921 cases with a death rate of 29.31 per cent. in 1923 and 800 cases with a death rate of 23.5 per cent. in 1922.

The increase in hospital admissions is partly due to the activities of the Sanitary Branch in discovering cases and recommending hospital admission. The number of hospital admissions again does not indicate the actual prevalence of the disease, for some cases reported as deaths from pyrexia are due to enteric fever, although the bulk are probably due to malaria.

The Registrar-General's returns show that 816 deaths from enteric fever and 17,697 deaths from pyrexia of unknown origin were registered during the year, and undoubtedly some of the latter should have been included in the former. The corresponding figures in his returns for the previous year were 597 and 23,328 respectively. Patients are usually taken to the hospitals for admission in late stages of the disease, and the mortality rate of these cases is therefore high. The following table gives some evidence of the incidence of the disease in Colombo and the Provinces as judged from hospital admissions :—

|                           | 1922.  |         | 1923.  |         | 1924.  |         |
|---------------------------|--------|---------|--------|---------|--------|---------|
|                           | Cases. | Deaths. | Cases. | Deaths. | Cases. | Deaths. |
| General Hospital, Colombo | 292    | 95      | 255    | 104     | 290    | 102     |
| Western Province          | 188    | 33      | 335    | 87      | 571    | 140     |
| Central Province          | 142    | 29      | 118    | 26      | 167    | 35      |
| Northern Province         | 26     | 4       | 20     | 2       | 50     | 9       |
| Eastern Province          | 7      | 2       | 4      | 1       | 4      | 2       |
| Southern Province         | 78     | 11      | 91     | 16      | 214    | 47      |
| North-Western Province    | 16     | 7       | 27     | 9       | 16     | 7       |
| North-Central Province    | 8      | 2       | 9      | 1       | 10     | 4       |
| Province of Uva           | 10     | 2       | 6      | 1       | 40     | 8       |
| Province of Sabaragamuwa  | 33     | 3       | 55     | 23      | 237    | 53      |
| Railway Extensions        | —      | —       | 1      | —       | 1      | 1       |
| Total                     | 800    | 188     | 921    | 270     | 1,600  | 408     |

18. *Diphtheria.*—Nineteen cases with 7 deaths were recorded during the year, as against 15 cases with 6 deaths during the previous year. Of the former, 8 cases with 2 deaths and 1 case with 1 death were reported from the Infectious Diseases Hospital, Colombo, and the General Hospital, Colombo, respectively. Three cases with 1 death from the Western Province, 6 cases with 2 deaths from the Central Province, and 1 case with 1 death from the Northern Province.

19. *Influenza.*—A mild form of influenza prevailed in all the Provinces at different periods of the year ; 3,888 cases were treated in Government hospitals with 115 deaths, a mortality rate of only 2.9 per cent. The corresponding figures for the previous year were 4,443, 162, and 3.64 per cent. respectively.

30,719 cases were treated at dispensaries during the year, as against 23,372 cases in 1923.

Of the total number of cases treated during the year, 5,112 out-patients and 1,233 in-patients were treated in the Western Province, 15,544 and 1,208, respectively, in the Central Province.

20. *Dysentery*.—Cases of dysentery were reported from all the Provinces during the year. The number treated in Government hospitals was 6,165 with 1,217 deaths, as against 5,884 and 993 respectively the previous year and 3,446 with 673 deaths in 1922. Of the in-patients treated during the year, 1,123 cases with 112 deaths were reported from the Western Province, 1,022 cases with 237 deaths from the Province of Sabaragamuwa, and 1,335 cases with 423 deaths from the Central Province.

Drinking water obtained from shallow, unprotected wells is the most common source of infection, and unusually heavy rains with consequent flooding causes pollution of the villagers' water supply. 4,080 deaths from dysentery were registered by the Registrar-General's Department during 1924, as against 3,326 in 1923 and 2,515 in 1922.

21. *Cancer and Carcoma*.—The number of patients admitted to the various hospitals during the year with malignant growths was 434 with 57 deaths, as compared with 443 cases with 59 deaths in 1923, 463 cases with 79 deaths in 1922, and 395 cases with 64 deaths in 1921.

The total number of deaths from "cancer or malignant diseases" reported by the Registrar-General was 473, as against 433 registered in 1923 and 461 in 1922. Twenty-eight cases of cancer were admitted to the Lady Havelock Hospital for Women, Colombo, during the year under review: of the cervix uteri 23, breast 2, bowel 2, and glands of neck 1 (secondary).

The admission during the previous year were: cancer of the cervix uteri 17, of the uterus 4, ovary 1, breast 2, liver 1, bowel 1, vulva 2, vagina 1, rectum 1, and anus 1. The average age was 38.96 in 1924, 41.16 in 1923.

The following is an analysis of admissions for cancer to the General Hospital, Colombo, in 1924:—

| Site.                    | Number of Cases. | Average Age.    | Male. | Female. | Operated.              | Inoperable. | Refused Operation. |
|--------------------------|------------------|-----------------|-------|---------|------------------------|-------------|--------------------|
| Cheek                    | 67               | 45              | 51    | 16      | 23                     | 38          | 6                  |
| Jaw                      | 21               | 48.2            | 14    | 7       | 5                      | 9           | 7                  |
| Lip                      | 8                | 45.6            | 6     | 2       | 5                      | 1           | 1                  |
|                          |                  |                 |       |         | 1 electrical treatment |             |                    |
| Tongue                   | 24               | 47.4            | 21    | 3       | 12                     | 7           | 5                  |
| Throat                   | 1                | 25              | —     | 1       | —                      | 1           | —                  |
| Tonsil                   | 1                | 35              | 1     | —       | —                      | —           | 1                  |
| Palate                   | 4                | 50.5            | 2     | 2       | 1                      | 3           | —                  |
| Floor of mouth           | 1                | 48              | 1     | —       | —                      | 1           | —                  |
| Stomach                  | 1                | 50              | 1     | —       | 1                      | —           | —                  |
| Cancer intestine         | 1                | 40              | 1     | —       | 1                      | —           | —                  |
| Rectum                   | 6                | 32.6            | 4     | 2       | 1                      | 5           | —                  |
| Cancer of larynx         | 4                | 57.5            | 2     | 2       | —                      | 4           | —                  |
| Cancer of paratoid       | 1                | 55              | 1     | —       | —                      | 1           | —                  |
| Cancer of thyroid        | 1                | 50              | —     | 1       | —                      | 1           | —                  |
| Cancer of breast         | 20               | 50.9            | 1     | 19      | 10                     | 5           | 5                  |
| Glands of neck           | 2                | 25              | 1     | 1       | 1                      | 1           | —                  |
| Glands of groin          | 2                | 41              | 2     | —       | 1                      | 1           | —                  |
| Penis                    | 27               | 50.6            | 27    | —       | 16                     | 5           | 6                  |
| Prostate                 | 1                | 29              | 1     | —       | 1                      | —           | —                  |
| Uterus                   | 14               | 45.5            | —     | 14      | —                      | 11          | 3                  |
| Vulva                    | 3                | 41.6            | —     | 3       | 1                      | 2           | —                  |
| Sacrum                   | 1                | 50              | 1     | —       | —                      | 1           | —                  |
| Lower limit              | 2                | 48              | 2     | —       | 1                      | 1           | —                  |
| Hand                     | 1                | 35              | 1     | —       | 1                      | —           | —                  |
| Eyelid                   | 1                | 60              | 1     | —       | 1                      | —           | —                  |
| Endothelioma of paratoid | 1                | 30              | 1     | —       | 1                      | —           | —                  |
| Sarcoma of lung          | 1                | 2 $\frac{1}{2}$ | —     | 1       | —                      | 1           | —                  |
| Melanotic sarcoma        | 1                | 44              | 1     | —       | 1                      | —           | —                  |

The total number of cases admitted to all the other hospitals in the Provinces was 76: 39 males and 37 females. Cancer of the cheek 15, breast 3, jaw 6, lip 2, tongue 9, mouth 3, neck 1, uterus 7, cervix uteri 13, scalp 2, liver 2, penis 12, and rectum 1. The average age was: males 51.07, females 49.05. Of the total number of cases reported, 50.31 per cent. were of the buccal cavity, due, it is said, to the habit of chewing betel with lime.

22. *Anchyllostomiasis*.—153,488 cases were treated at dispensaries during the year, and the following table of hospital admissions during the last four years indicates the relative prevalence and mortality of this disease in the various Provinces:—

|                           | 1921.  |         | 1922.  |         | 1923.  |         | 1924.  |         |
|---------------------------|--------|---------|--------|---------|--------|---------|--------|---------|
|                           | Cases. | Deaths. | Cases. | Deaths. | Cases. | Deaths. | Cases. | Deaths. |
| General Hospital, Colombo | 772    | 135     | 588    | 81      | 573    | 134     | 554    | 72      |
| Western Province          | 1,619  | 250     | 1,575  | 156     | 2,030  | 137     | 1,751  | 119     |
| Central Province          | 3,643  | 584     | 2,519  | 281     | 2,957  | 270     | 2,907  | 275     |
| Southern Province         | 1,348  | 145     | 1,418  | 110     | 1,222  | 88      | 1,410  | 58      |
| Province of Sabaragamuwa  | 1,728  | 271     | 1,579  | 155     | 2,128  | 194     | 2,686  | 142     |
| North-Western Province    | 529    | 74      | 754    | 74      | 809    | 85      | 737    | 68      |
| Province of Uva           | 968    | 194     | 827    | 111     | 869    | 83      | 792    | 76      |
| Eastern Province          | 59     | 11      | 111    | 5       | 225    | 13      | 371    | 20      |
| North-Central Province    | 197    | 29      | 42     | 2       | 155    | 8       | 148    | 9       |
| Northern Province         | 219    | 29      | 405    | 7       | 333    | 15      | 357    | 26      |
| Railway Extensions        | —      | —       | —      | —       | 43     | 3       | 15     | —       |
|                           | 11,082 | 1,721   | 9,822  | 982     | 11,344 | 1,030   | 11,728 | 865     |

These figures refer to cases of ancylostomiasis as the primary disease; but owing to the almost universal infection of all hospital and dispensary patients, mass treatment for this disease was carried out during the year at dispensaries and hospitals, and a large number of persons received necessary treatment.

Report submitted by Dr. J. F. Docherty of the Rockefeller Foundation:—

ANCHYLOSTOMIASIS CAMPAIGN, 1924.

I.—Organization.

The organization was similar to that of previous years, the campaign being under the direction of a representative from the International Health Board, who was assisted by Medical Officers belonging to the Ceylon Medical Department and advised by a special Ankylostomiasis Committee.

II.—Personnel.

(a) *International Health Board Staff.*—(1) The campaign was favoured by a visit from Dr. W. A. Sawyer, Assistant Regional Director for the East, who arrived in Ceylon in January and remained practically three months. Dr. Sawyer acted as an advisory officer, and assisted in the problem of reconstruction and in formulating a permanent control programme. (2) Dr. W. C. Swet arrived in Ceylon December 24, preparatory to taking charge of the work after the departure of the present Director, who goes on leave early in 1925. (3) Dr. J. Frank Docherty acted as Director in charge throughout the entire year.

(b) *Local Staff.*—Two changes were made in the staff assigned to the department by the Principal Civil Medical Officer. (1) Dr. J. M. Hall was transferred to the estate inspection division August 15, being replaced by Dr. A. T. Kuriyan. (2) As the services of an additional junior medical officer were required for the Island-wide survey, Dr. E. Jayatilleke was appointed by the Principal Civil Medical Officer as Assistant Director, Ankylostomiasis Campaign, in charge of the itinerating laboratory unit.

(c) *Subordinate Staff.*—The subordinate staff was enlarged by one-half unit—four dispensers or microscopists to provide Dr. Jayatilleke with sufficient staff to make the Island-wide survey.

(d) Summarized the personnel of the staff was as follows:—

Unit No. 1.—Dr. E. S. Godlieb, Homagama

|               | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|---------------|------|------|------|--------|------|-------|-------|------|-------|------|------|------|
| Director      | ..   | ..   | 1 .. | 1 ..   | 1 .. | 1 ..  | 1 ..  | 1 .. | 1 ..  | 1 .. | 1 .. | 1 .. |
| Assistant     | ..   | ..   | 1 .. | 1 ..   | 1 .. | 1 ..  | 1 ..  | 1 .. | 1 ..  | 1 .. | 1 .. | 1 .. |
| Clerks        | ..   | ..   | 2 .. | 2 ..   | 2 .. | 2 ..  | 2 ..  | 2 .. | 2 ..  | 2 .. | 2 .. | 2 .. |
| Dispensers    | ..   | ..   | 8 .. | 8 ..   | 8 .. | 8 ..  | 9 ..  | 8 .. | 8 ..  | 8 .. | 8 .. | 8 .. |
| Microscopists | ..   | ..   | —    | —      | —    | —     | —     | —    | —     | 1 .. | 1 .. | —    |
| Caretakers    | ..   | ..   | 1 .. | 1 ..   | 1 .. | 1 ..  | 1 ..  | 1 .. | 1 ..  | 1 .. | 1 .. | 1 .. |

Unit No. 2.—Dr. T. K. Jayaram.

|               | Peradeniya. | Matale. | Dimbula. |
|---------------|-------------|---------|----------|
| Director      | ..          | 1 ..    | 1 ..     |
| Assistant     | ..          | 1 ..    | 1 ..     |
| Clerks        | ..          | 2 ..    | 2 ..     |
| Dispensers    | ..          | 7 ..    | 7 ..     |
| Microscopists | ..          | —       | —        |

Half Unit No. 3 (attached to Unit No. 2).—Dr. J. M. Hall, Mirigama-Minuwangoda-Veyangoda.

|            |    |    |   |   |    |   |    |      |      |      |    |   |
|------------|----|----|---|---|----|---|----|------|------|------|----|---|
| Director   | .. | .. | — | — | .. | — | .. | —    | ..   | —    | .. | — |
| Assistant  | .. | .. | — | — | .. | — | .. | 1 .. | 1 .. | 1 .. | .. | — |
| Clerks     | .. | .. | — | — | .. | — | .. | —    | ..   | —    | .. | — |
| Dispensers | .. | .. | — | — | .. | — | .. | 4 .. | 4 .. | 4 .. | .. | — |
| Caretakers | .. | .. | — | — | .. | — | .. | —    | ..   | —    | .. | — |

Half Unit No. 4.—Dr. S. de Simon.

|               | Mahara Area. | Jaffna. | Itinerating Western Province. |
|---------------|--------------|---------|-------------------------------|
| Director      | ..           | ..      | ..                            |
| Assistant     | ..           | 1 ..    | 1 ..                          |
| Clerks        | ..           | 1 ..    | 1 ..                          |
| Dispensers    | ..           | 4 ..    | 4 ..                          |
| Microscopists | ..           | —       | —                             |
| Caretakers    | ..           | 1 ..    | 1 ..                          |

Half Unit No. 5.—Dr. A. T. Kuriyan, Weligama Area.

|            |    |    |   |   |    |   |    |      |      |      |      |      |
|------------|----|----|---|---|----|---|----|------|------|------|------|------|
| Director   | .. | .. | — | — | .. | — | .. | 1 .. | 1 .. | 1 .. | 1 .. | 1 .. |
| Assistant  | .. | .. | — | — | .. | — | .. | —    | ..   | —    | ..   | —    |
| Clerks     | .. | .. | — | — | .. | — | .. | —    | ..   | —    | ..   | —    |
| Dispensers | .. | .. | — | — | .. | — | .. | —    | ..   | 4 .. | 4 .. | 4 .. |
| Caretakers | .. | .. | — | — | .. | — | .. | —    | ..   | —    | ..   | —    |

Half Unit No. 6.—Dr. E. Jayatilleke.

|               | Itinerating northern half of Island. | Upcountry. |
|---------------|--------------------------------------|------------|
| Director      | ..                                   | ..         |
| Assistant     | ..                                   | ..         |
| Clerks        | ..                                   | ..         |
| Dispensers    | ..                                   | 3 ..       |
| Microscopists | ..                                   | 4 ..       |
| Caretakers    | ..                                   | 1 ..       |

## Central Office.

|                  | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
|------------------|------|------|------|--------|------|-------|-------|------|-------|------|------|------|
| Director ..      | ..   | 1 .. | 1 .. | 1 ..   | 1 .. | 1 ..  | 1 ..  | 1 .. | 1 ..  | 1 .. | 1 .. | 1 .. |
| Assistant ..     | ..   | —    | —    | —      | —    | —     | —     | —    | —     | —    | —    | —    |
| Clerks ..        | ..   | 1 .. | 1 .. | 1 ..   | 1 .. | 2 ..  | 1 ..  | 1 .. | 1 ..  | 1 .. | 1 .. | 1 .. |
| Dispensers ..    | ..   | 1 .. | 1 .. | 1 ..   | 1 .. | 1 ..  | —     | ..   | 1 ..  | 1 .. | 1 .. | 1 .. |
| Microscopists .. | ..   | 3 .. | 3 .. | 1 ..   | 2 .. | 3 ..  | 3 ..  | 3 .. | 4 ..  | 4 .. | 3 .. | 2 .. |
| Caretakers ..    | ..   | 2 .. | 2 .. | 2 ..   | 2 .. | 2 ..  | 2 ..  | 2 .. | 2 ..  | 2 .. | 2 .. | 2 .. |

## III.—Programme.

Previous to the visit of Dr. W. A. Sawyer the activities of the ancylostomiasis campaign were more or less confined to demonstrations of the feasibility of control. It is true attempts were made by various Directors during the estate treatment period to devise a scheme by which treatment would be continued by the individual estates. This apparently was abandoned until 1922, when the present Director attempted to enforce treatment by the estates through the Inspecting Medical Officers. As there were only three of these officers employed until 1923, the effect of their visits was but slightly felt.

In June, 1923, a village-estate demonstration area was selected for control measures providing sanitation was in a satisfactory condition by January, 1924, the date on which it was planned to start treatment. This combination was made as the majority of the estates practically refused to treat their labour forces unless the villages interpersed among the estates were sanitized and treated at the same time. As mentioned in the 1923 report, the villages were sanitized by the Sanitary Department staff according to schedule, while the estates, with but few exceptions, were in an unsatisfactory condition. As a result, treatment was confined to the villages.

In December, 1923, the Dimbula district was reported by the Inspecting Medical Officer, Central Province, as being 90 per cent. sanitized—lines, compounds, and general hygienic construction meeting Government standards. This area was at once selected as a suitable estate area for a further demonstration of control, provided the estates undertook to treat the entire labour force annually in future years without the assistance but with the advice and supervision of this office. Action on this matter was deferred until after the arrival of Dr. W. A. Sawyer.

On arrival of Dr. Sawyer definite assurance was given that the International Health Board would assist in devising a programme of permanent control for estates and villages. After consulting the Ancylostomiasis Committee the following scheme was adopted:—

- (1) Re-treatment of village areas as necessitated by reinfection and permitted by the personnel available; actual treatment to be carried out by the ancylostomiasis campaign staff.
- (2) A demonstration of the feasibility of control on estates in the Dimbula Planters' Association. Annual treatments, or, as reinfection demanded it, of all coolies on the estate at the expense of the estate. Reinfection rates and retreatment intervals to be determined by this office.

The effect of this programme has not been, nor will for some time be, fully observed, although fair progress has been made during the year. The principal result has been the commencement of retreatment in the village areas January 1, 1925. This was the outcome of a resurvey, using Stoll's egg-count method, when the quantity of original infection remaining in treated areas—two treatments per person—was found to be 24 per cent., while the rate of reinfection was established as 1·2 per cent. of original infection per month over a period of 33 months.

## IV.—Extent of Operations.

## (A) SURVEY.

1. At the request of Dr. W. A. Sawyer a survey of selected areas was made to determine the percentage of infection. Dr. Simon, with the necessary subordinate staff, was assigned to this work February 1 for a period of 4 weeks. A total of 4,072 examinations were made, the results being, as anticipated, 89·5 per cent. infected.

2. As ordinary examinations gave but little information as to the degree of individual infection, Dr. Sawyer approved an Island-wide survey, using Stoll's egg-count method. This was started on the receipt of laboratory material, Dr. Simon took charge June 1, and was succeeded by Dr. Jayatilleke June 21. An average of 1,000 examinations was made at selected centres in the Northern, North-Central, North-Western, and parts of the Central and Eastern Provinces, a total of 10,488 counts being made before December 21, 1924.

These egg-counts have been analysed and are recorded in Table I. Contrary to our belief, infection in the districts completed is not proportionate to rainfall. This may be explained by the living conditions of the villagers, as, for example, Jaffna District being one of the most densely populated and least sanitized in Ceylon, one would expect a very high individual infection. This was not borne out by examinations, and is accounted for by the entire absence of tanks, the presence of brackish water due to the slight elevation above sea level, and to the prolonged drought period.

Turning to the North-Central Province, the most sparsely settled of all districts in Ceylon, we would expect a very much lighter infection, especially since, with but one or two exceptions, all towns are merely collections of huts in the jungle. Again the unexpected happens, higher individual infection, and in some places an astonishingly heavy infection, being observed. This is attributed to the proximity of the villages to tanks, as the North-Central Province is abundantly supplied with these small lakes, the remnants of the irrigation scheme of early inhabitants. These tanks are surrounded by bunds or dykes constructed of soil removed from the centre of the lake, and on the average, though exceedingly well built, are fairly porous. As a result, a certain amount of seepage occurs along the bunds, and it is here that villagers invariably build their homes for three main reasons:—

- (1) Accessibility of water supply for irrigation and other purposes.
- (2) Coolness of locality.
- (3) Increased productiveness of the soil due to continuous moisture.

The inevitable happens, especially in view of the total absence of sanitation. The infected faeces are deposited on an ideal culture medium, produce a heavy soil infestation, with consequent heavy individual infection.

Again it is noted that the infection among the coolies is without exception much higher than among the villagers in the same town. This, and the infection in Moorish villages, is due solely to the personal habits and living conditions of the people. Other villages requiring special consideration might be discussed, but they are of purely local interest.

That infection is dependent in part at least on rainfall is demonstrated by comparing worm-count estimations in the following six Sinhalese villages; sanitation, food supply, living conditions, and medical aid being practically on a par throughout:—

Table II.

| Centre.        | Number of Average Examinations. | Worm-count. | Rainfall. In.     |
|----------------|---------------------------------|-------------|-------------------|
| Negombo        | 169                             | 27.1        | 69.1              |
| Kurunegala     | 129                             | 30.4        | 80.7              |
| Homagama       | 424                             | 35.5        | 98.4              |
| Henaratgoda    | 1,114                           | 36.4        | 99.5              |
| Mirigama South | 397                             | 42.8        | 104.0             |
| Hanwella       | 780                             | 49.7        | 120.0 (estimated) |

3. A survey to determine effect of altitude on infection was started in November, and though incomplete at the end of the year, gives conclusive evidence of the writer's conviction that at very high altitudes in Ceylon individual infection is considerably less than on the mid-country estates between 1,000 to 2,500 feet.

The following table gives results up to January 1, 1925:—

| Altitude. Feet. | Number examined. | Average Worm-count. |
|-----------------|------------------|---------------------|
| 2,500           | 66               | 16.2                |
| 3,000           | 41               | 19.5                |
| 3,500           | 295              | 23.5                |
| 4,000           | 149              | 14.5                |
| 4,500           | 185              | 15.3                |
| 5,000           | 166              | 15.7                |
| 5,500           | 352              | 15.2                |
| 6,000           | 183              | 12.2 to these may   |
| Sea level       | 268              | 51.3 be added       |
| 1,200           | 43               | 55.5                |

4. *Western Province (Treated Districts).*—As village control measures are dependent on the rate of reinfection, examinations were made of representative groups of villagers in the various treated areas in Western Province to estimate this rate. As this has been reported in detail a summary only will be included.

It was found that in a recently completed area, when the villagers' statement as to the number of treatments was accepted as final, those who had taken one treatment only still harboured 40.3 per cent. of the original infection, while those who stated they had taken two retained an average of 24.8 per cent. The various areas examined gave increasing quantities of infection as the treatment-examination interval increased, until in the case of Minuwangoda (the first district treated) the infection in 33 months had reached 66.9 and 64.3 per cent. of original infection. From this it was concluded, that provided sufficient staff was available, retreatment should be carried out every 2½ years, also, as the quantities of infection present were practically identical, irrespective of treatments, a programme of repeated mass treatments might be advantageously adopted.

As a result of egg-counts made before, immediately after 2, 4, 6, and 8 months after treatment the rate of reinfection among the cooly labourers was found to be 1.66 per cent. per month over a period of 12 months; comparing this with 2.5 per cent. per month for 11 months among the villagers, proof is obtained of the value of enforcing construction and maintenance of lines, compounds, latrines, &c., in accordance with Government regulations. It should be stated that in the villages examined 73 per cent. of homes were supplied with approved latrines, 66 per cent. of which were found to be more or less in actual use, while on the estate mentioned sanitation was perfect and soil pollution reduced to as near a minimum as is possible among coolies.

#### (B) TREATMENT—VILLAGE AREAS.

1. *Mahara or Ragama Area.*—Treatment in this area was started by Dr. E. S. Godlieb in October, 1923. Except for second treatments the original headmen's divisions were finished by February, 1924, when Dr. Simon (who had relieved Dr. Godlieb) and his staff were sent to various parts of the Island to make an infection survey; at the end of the month the staff was returned to Mahara. As a large number of villagers from the non-sanitised Siyane korale west were coming miles to the dispensaries, the original field was enlarged to include a few of the near-by headmen's divisions. Treatment was discontinued May 1, to permit of the Island-wide survey, the sanitised district and part of Siyane korale west having been completely treated.

2. *Peradeniya.*—As mentioned earlier in this report, in June, 1923, a combined village-estate area was selected for treatment January, 1924, six months being allowed villagers and estates to construct the required latrines. The Sanitary Commissioner appointed the necessary staff at once, while the estates were instructed to make every effort to bring their lines, compounds, and latrines up to standard. Unfortunately the majority of the estates were in an unsatisfactory condition when visited in November, 1923; in some places no attempt being made or contemplated. As a result, when the staff was assigned to Peradeniya in January, 1924, instructions were issued and the estates informed that no coolies were to be treated at the expense of the campaign, our efforts being confined to the village districts.

The response during the first two weeks was most encouraging, but during the third week a number of those treated developed symptoms of poisoning, although the maximum adult dose administered was 40 minimis for one patient only, the remainder 35 or less, and for children twice the age in minimis. All denied alcohol, though a few later admitted their guilt, which, therefore, would account for certain cases of illness. As to the upsets among young children, two of which were seen by the writer and were quite ill, no explanations can be given, unless the drug used (made by Goddard, Albright & Wilson, Ltd., of England) contained some unknown impurity, as it had been tested and approved by the Government Analyst for the Crown Agents. Since February 1, 1924, the only carbon tetrachloride used in Ceylon has been supplied by New York office, purchased from the Eastman Kodak Company.

Due to this regrettable incident, the attendance at the dispensaries rapidly decreased, and was so discouraging, in spite of the wholehearted assistance of the Government Agent, Assistant Government Agent, Office Assistant, Ratmalhatmayas, and our staff, that the offices were closed May 31, 1924. During the last two months special efforts were made to reassure the villagers; in addition, all the coolies on a number of small estates in the densely populated village district were treated.

3. *Homagama Campaign.*—Dr. E. S. Godlieb, assisted by Dr. W. S. Fernando, was assigned to Homagama district, south of the Kelaniya, January 1, 1924. This area is composed of all villages in the headmen's divisions of Hewagam korale, though only 36 were selected for treatment during the year.

Due to the assistance of the Government Agent, the Assistant Government Agent of Western Province, the Mudaliyar of the korale, and local staff, out of a census of 37,439 villagers, 29,964 presented themselves for treatment, 21,163 taking the second round. The only villages in which difficulty was met were Homagama and Pannipitiya, where a fair percentage of the residents are shoc-wearers, being members of the clerical staffs of various Colombo firms.

4. *Weligama*.—Dr. J. M. Hall was transferred to Kandy as Assistant Inspecting Medical Officer August 15, being replaced by Dr. Kuriyan, who spent the first two weeks of September with Dr. Gedlieb in order to become familiar with campaign methods. September 15 he proceeded to Weligama in the Southern Province, taking census September 17 to 30, and beginning treatment October 1.

This village area had been selected for treatment several years before sanitation being brought up to the standard, but unfortunately when all preparations had been completed the rizo crisis developed. The Sanitary Commissioner advised this office in January, 1924, that, in view of the sanitary status and the small efforts required to bring it up to standard, he considered this district as an optimum place to begin treatment in Southern Province. The necessary sanitary inspectors were assigned at once, and September 1 advice was received that over 60 per cent. of houses in certain headmen's divisions had been supplied with latrines.

As mentioned, treatment started October 1 under the direction of Dr. Kuriyan, assisted by 1 clerk and 4 dispensers. By the end of the year 11,777 doses of the vermifuge were administered to 7,865 villagers. Some villages of 500 and over were finished in less than six days, as many as 300 being observed by the writer as present at two different dispensaries on the occasion of a surprise visits.

#### ESTATE AREAS.

1. *Matale Estate Campaign*.—Due to the demonstration and investigations carried out on North Matale estate, Matale, considerable interest in ancylostomiasis control was aroused among the superintendents of the various estates. Such a number of requests for assistance were received, that it was decided to grant each estate in the Planters' Association one day's assistance in the treatment of its labour force; provided—

- (1) Sanitation and living conditions met the requirements of the Principal Civil Medical Officer's Department;
- (2) A competent dispenser was employed by each large estate or by several small estates;
- (3) All coolies not treated by our staff would be treated by the estate at the rate of 100 per diem until completion;
- (4) All new coolies would be treated on arrival;
- (5) The entire labour force would be treated once annually.

Eight estates having agreed to the above in March, the Director for Ceylon treated the entire force at once; the remaining 57 being assisted by Dr. Jayaram's half unit, which had been transferred from Peradeniya June 1.

The results of treatment as evidenced by letters received from various superintendents have been most encouraging. The *ex* Chairman of the Ceylon Planters' Association writes:—

"Ukuwela Estate,  
"December 8, 1924.

"I am in receipt of your letter of December 3 *re* the effects of ancylostomiasis treatment given during second quarter, 1924.

"I regret that I can only reply in general terms by stating that I consider the treatment has been most beneficial to my coolies, both as regards their general health and also their working capabilities.

"Unfortunately so many coolies are going from and coming to the estate that it is impossible to keep in touch with a large proportion of those who were treated.

"A great point about the new treatment is that it is so popular with the labour force and I now frequently get voluntary requests from coolies for treatment."

The superintendent of a large group of estates writes:—

"Weygalla and Elakaduwa Group,  
"December 20.

"In reply to your letter of 3rd instant, I have much pleasure in advising you that, subsequent to the ancylostomiasis treatment given to my labour forces during the second quarter of 1924, the general all-round health would appear to have distinctly improved; this is reflected in their working capacity.

"With regard to vital statistics, I may say that no patients have been sent to the Government hospital for ancylostomiasis during the second quarter; deaths 1 only, births 12, dispensary attendance 15."

2. *Dimbula District*.—On completion of estate treatment in Matale District August 25, Dr. Jayaram, with 2 dispensers and 1 clerk, was transferred to the Agra section of Dimbula district. Treatment actually began September 5, a slight delay being necessitated by the Director's transfer and illness. All estates visited during the remainder of the year gave their full support, presenting from 350 to 450 coolies per diem at the treatment sheds, the minimum accepted by the staff being 350, unless census was less than that number. In the three working months before the close of the year 42 estates were visited and 16,384 coolies treated.

The results as far as the health of the cooly is concerned will not be nearly so pronounced in the Agras as in Matale, since preliminary egg-counts made revealed a very light infection and practically no parasites present after treatment.

#### (C) SCHOOL TREATMENTS.

When Dr. Simon was transferred from Mahara to Jaffna peninsula to make an Island-wide egg-count survey, he was supplied with sufficient dispensers to collect all specimens required, as well as treat such villages and schools as was anticipated would request treatment. To our surprise the demand for treatment far exceeded the working capacity of the staff. The Principal Civil Medical Officer was at once requested to assign an additional Assistant Medical Officer to take charge of the laboratory, in order to permit Dr. Simon to return to Jaffna and treat all school children and adults who desired our assistance. A total of 324 schools in the peninsula were visited, 33,902 children receiving one dose of carbon tetrachloride-chenopodium according to the dosage sheet No. 7,654 forwarded by Dr. F. F. Russell. This required the whole-time efforts of Dr. Simon and 4 dispensers for a period of 12 weeks, as many as 600 children being treated in one day.

## (D) HOSPITAL, DISPENSARY, AND ITINERATING UNIT TREATMENTS.

A certain number of large out-patient centres received assistance from the staff during the year, while in addition the dispensers attached to the travelling laboratory assisted at various dispensaries when they were not engaged in collecting specimens or treating at schools. A total of 18,088 were administered to out-patients and 3,498 to school children in addition to those mentioned in paragraph (C).

## (E) ACTIVITIES OF GOVERNMENT MEDICAL INSTITUTIONS.

The returns received from the majority of the Government hospitals and dispensaries have been most encouraging, although a small percentage of District Medical Officers and apothecaries do not appear to have benefited by our instructions. This applies particularly to Uva and Eastern Provinces, where the percentage of out-patients treated is very low; in Uva during the last 2 months a decided improvement was observed as a result of the efforts of the Provincial Surgeon at the request of the Principal Civil Medical Officer's office. Table III. gives treatments by Provinces and percentage of out-patients treated using the out-patient dispensary attendance for 1923 as a working basis:—

Table III.

| Province.     | Treatments for Anchylostomiasis 1924.<br>First Treatment. | Total Treatments. | Out-patient Attendance, Persons. 1923. | Percentage of Patients treated for Anchylostomiasis. Per Cent. |
|---------------|---|-------------------|--|--|
| Western       | .. 122,211 ..   | 154,926           | 555,048 ..                             | —  |
| Central       | .. 109,586 ..   | 130,161           | 370,380 ..                             | 29·6   |
| North-Central | .. 54,845 ..  | 66,049            | 186,041 ..                             | 29·4   |
| *Sabaragamuwa | .. 122,626 ..   | 156,853           | 257,867 ..                             | —  |
| North-Western | .. 140,198 ..   | 173,807           | 510,605 ..                             | 27·5   |
| Eastern       | .. 31,180 ..  | 40,814            | 239,436 ..                             | 13·0   |
| Northern      | .. 52,335 ..  | 64,408            | 190,637 ..                             | 27·5   |
| Uva           | .. 21,933 ..  | 24,346            | 100,076 ..                             | 21·9   |
| Southern      | .. 121,999 ..   | 169,541           | 290,431 ..                             | —  |
|               | 776,913   | 980,905           | 2,700,521                              |  |

\* December report not received (*vide* page 23).

## (F) ESTATE HOSPITALS AND DISPENSARIES.

Although the various estates, as a result of articles, instructions, and advices sent from this office during the year, have taken more interest in anchylostomiasis treatment than in former years, still the returns received to date are not encouraging. It is impossible to form an estimate of the number of treatments given throughout the 12 months, as these reports are still incomplete, but the replies from 500 estates to a questionnaire from this office listed only 18,822 treatments for the first 6 months of 1924.

## V.—Sanitation.

## (A) VILLAGE.

The Sanitary Commissioner on every occasion assigned a sufficient number of inspectors to areas selected for treatment, to permit the construction of approved latrines at a minimum of 60 per cent. of houses before treatment was actually started. The survey of Homagama made on completion of treatment showed that at 3,065 of the houses in the treated area 2,231 latrines had been built, 360 were under construction, and from observation 60 per cent. of these were in actual use.

A sanitary survey of the various village areas treated during the last 4 years proved definitely that the latrines in the majority of cases at least are well constructed and last much longer than anticipated. In the treated section resurveyed, out of the 16,551 homes, 12,090 or 73 per cent. were supplied with serviceable latrines and over 60 per cent. of these were in actual use.

## (B) ESTATE.

To a casual observer revisiting Ceylon after an absence of 3 to 5 years, a wonderful change is noted in the living conditions of the coolies. Instead of the old mud and wattle lines surrounded by overgrown coolies' gardens and devoid of compounds and latrines, to-day practically everywhere one sees standard stone or brick built lines with galvanized or tile roofs, stone compounds free from vegetation, refuse, and standing water, running water supplied from non-contaminated sources, and the best of modern latrines either of the portable bucket or pit type. With this general improvement a change in the health of the cooly can certainly be expected, since anchylostomiasis reinfection is reduced considerably due to decreased soil pollution, while the general improvement in hygiene and sanitation ought to reduce the incidence of such diseases as typhoid, para-typhoid, and dysentery.

## VI.—Education.

1. The Sanitary Commissioner's staff gave their instructive series of lectures to all village headmen in areas where pre-sanitary campaigns were in progress. The majority of the vidane arachchies, police vidanes, and headmen attended all demonstrations, lectures, and examinations; a fair percentage receiving the much-coveted certificates.

## 2. Campaign.—

- (a) Lectures were given in different villages to all headmen and on various estates during the course of the treatment campaigns.
- (b) Pamphlets in English, Sinhalese, and Tamil were distributed and read to all who attended treatment centres.
- (c) A pamphlet for use of children in schools was approved by the Medical Department and the Director of Education.
- (d) A travelling laboratory display giving in detail the life-history of hookworm infection was sent to all campaign areas, also to certain fairs and agri-horticultural shows.

VII.—**Laboratory Report.**

All specimens received during the first 3 months of 1924 were examined by the old method of direct smear, centrifuge, and salt flotation. Of the total of 4,431, 1,023 were found to be negative by the direct smear, but of this number 472 proved to be positive by salt flotation.

Starting in March with very limited equipment, all specimens received were examined by Stoll's egg-count method, those giving negative counts being checked by salt flotation examinations. By the end of the year a total of 26,960 counts were made on 26,960 specimens, divided as follows:—

|                            |    |    |    |        |
|----------------------------|----|----|----|--------|
| (1) Itinerating laboratory | .. | .. | .. | 12,984 |
| (2) Central laboratory     | .. | .. | .. | 10,649 |
| (3) Homagama campaign      | .. | .. | .. | 1,741  |
| (4) Dimbula                | .. | .. | .. | 1,506  |
| (5) Weligama               | .. | .. | .. | 80     |
|                            |    |    |    | 26,960 |

## Report of Microscopical Examinations made at Central Laboratory in Colombo during the Year 1924.

| Month.    | Preliminary Examination. |           | First Examination. |           | Second Examination. |           | Total. | Grand Total. |
|-----------|--------------------------|-----------|--------------------|-----------|---------------------|-----------|--------|--------------|
|           | Positive.                | Negative. | Positive.          | Negative. | Positive.           | Negative. |        |              |
| January   | 11                       | 3         | 12                 | 15        | —                   | —         | 23     | 18           |
| February  | 3,653                    | 432       | 5                  | 1         | 4                   | 5         | 3,662  | 438          |
| March     | 2                        | —         | 6                  | 2         | —                   | —         | 8      | 2            |
| April     | 15                       | —         | —                  | —         | —                   | —         | —      | 15           |
| May       | 6                        | 6         | 3                  | 2         | 4                   | 9         | 13     | 17           |
| June      | 88                       | 16        | 27                 | 21        | —                   | 7         | 115    | 44           |
| July      | —                        | —         | 23                 | 28        | 1                   | —         | 24     | 28           |
| August    | 1                        | —         | —                  | 1         | —                   | —         | 1      | 1            |
| September | 1                        | 1         | —                  | —         | —                   | 1         | 1      | 3            |
| October   | 2                        | —         | —                  | —         | —                   | —         | 2      | —            |
| November  | —                        | —         | —                  | —         | —                   | —         | —      | —            |
| December  | 16                       | —         | —                  | —         | —                   | —         | 16     | —            |
| Total     | 3,795                    | 458       | 76                 | 71        | 9                   | 22        | 3,880  | 551          |
|           |                          |           |                    |           |                     |           |        | 4,431        |

In addition 10,649 egg-counts were also made from March to December, 1924.

|   |    |    |    |       |
|---|----|----|----|-------|
| Total number of specimens centrifuged (examined by salt flotation method) | .. | .. | .. | 1,023 |
| Number found positive   | .. | .. | .. | 472   |
| Number found negative   | .. | .. | .. | 551   |

VIII.—**Special Activities.**

At the suggestion of the writer, the various District Planters' Associations, and finally the Ceylon Planters' Association, approved treatment of immigrant coolies at Mandapam. The question was next referred to the estate agencies and immigration authorities, who in turn gave their sanction, the outcome being that in September the Ceylon Government approved the measure, and it was forwarded to the Madras Government for consideration. In December the Madras Government advised the Colonial Secretary as follows:—

*Treatment at Mandapam Camp.*

SIR,—I AM directed to say that the Governor in Council is of the opinion that the treatment for ankylostomiasis may be started on a voluntary basis for the present, and may be made permanent after some experience is gained of its working.

When it is proposed to start compulsory treatment steps will be taken to see that—

- (a) Emigrants are fully apprised by recruiting agents before they leave their villages or homes of the compulsory treatment in the camp.
- (b) Arrangements are made for the return to their homes of emigrants who are not willing to undergo treatment at Mandapam.

I have the honour to be, Sir,  
Your obedient servant,

Secretary.

At the time of writing over 2,000 coolies have been treated at Mandapam, and not a single instance has been recorded in which a cooly refused treatment or felt any mal-effects from the drugs used.

IX.—**Drugs used.**

Carbon tetrachloride and chenopodium according to the following dosage table used throughout the major part of the campaign. In the treatment of school children in Jaffna the combination advised by Dr. F. F. Russell in his field memorandum No. 7,654 was used with exceedingly good results.

*Carbon Tetrachloride Dosage.*

|             |    |    |    |                       |
|-------------|----|----|----|-----------------------|
| 2-12 years  | .. | .. | .. | 1½ times age in years |
| 12-20 years | .. | .. | .. | Twice age in years    |
| 20-35 years | .. | .. | .. | 35-45 minims          |
| 35-40 years | .. | .. | .. | 35-40 minims          |
| 40-50 years | .. | .. | .. | 30-40 minims          |
| 50-55 years | .. | .. | .. | 20-30 minims          |

*Chenopodium Dosage.*

| Apparent Age. | Minims. | Apparent Age. | Minims. |
|---------------|---------|---------------|---------|
| 2 years       | 1       | 7 years       | 6       |
| 3 years       | 2       | 8 years       | 7       |
| 4 years       | 3       | 9 years       | 8       |
| 5 years       | 4       | 10 years      | 9       |
| 6 years       | 5       |               |         |

**X.—Official and General Support.**

Our thanks are due to the Colonial Secretary and Ankylostomiasis Committee for approving the programme for the year and lending all possible assistance to the staff; to the Principal Civil Medical Officer and Sanitary Commissioner, who were ever ready to grant us aid and advice in all our projects willingly, appointing such staff as were found to be required for the different campaign areas.

In the various campaign areas in the Western Province the Government Agent, Assistant Government Agent, and members of their staff gave us all aid required, and assisted in no small degree in making the campaigns successful.

Our gratitude is due to the Government Agent, Central Province, and the staff of the Kachcheri at Kandy for the wholehearted assistance and advice given us during the campaign in Peradeniya, which through no fault of theirs or ours had to be terminated May 31, 1924.

The school treatments in Jaffna and in other Provinces were made possible by the enthusiastic support of the Director of Education and his staff, while among the estates the Planters' Associations and individual superintendents were instrumental in convincing the coolies as to the advisability of taking treatment.

Table I.  
*Island-survey Egg-counts.*

| Location.           | Average Count. |             |                  | Average Count. |              |                  | Average Count.     |                  |          | Average Count.   |                  |          | Average Count.   |                  |          | Average Count.   |                  |          |
|---------------------|----------------|-------------|------------------|----------------|--------------|------------------|--------------------|------------------|----------|------------------|------------------|----------|------------------|------------------|----------|------------------|------------------|----------|
|                     | 3-6 Years.     | 7-10 Years. | Number examined. | 11-14 Years.   | 15-18 Years. | Number examined. | 19 Years and over. | Number examined. | Average. | Number examined. | Number examined. | Average. | Number examined. | Number examined. | Average. | Number examined. | Number examined. | Average. |
| Jaffna              | 122            | 3           | 6                | 4.3            | 52           | ..               | 27.3               | 16               | ..       | 30.1             | 19               | ..       | 30.8             | 67               | ..       | 34.6             | 111              |          |
| Kankesanturai       | 9              | 0           | 1                | 29.5           | 10           | ..               | 29.1               | 17               | ..       | 31.0             | 4                | ..       | 21.1             | 31               | ..       | 25.1             | 63               |          |
| Point Pedro         | 39             | 3           | 3                | 33.4           | 11           | ..               | 20.1               | 16               | ..       | 35.5             | 1                | ..       | 32.0             | 49               | ..       | 31.1             | 97               |          |
| Chavakachcheri      | 11             | 0           | 1                | 31.8           | 10           | ..               | 36.5               | 28               | ..       | 25.1             | 23               | ..       | 25.1             | 30               | ..       | 29.2             | 92               |          |
| Kodikamam           | 8              | 5           | 2                | 39.1           | 11           | ..               | 28.5               | 18               | ..       | 23.9             | 29               | ..       | 46.5             | 44               | ..       | 36.2             | 104              |          |
| Kayts               | 4              | 0           | 2                | 43.3           | 10           | ..               | 19.7               | 21               | ..       | 15.6             | 18               | ..       | 24.7             | 56               | ..       | 24.3             | 107              |          |
| Copay               | 135            | 1           | 7                | 26.0           | 5            | ..               | 27.7               | 11               | ..       | 31.4             | 12               | ..       | 25.3             | 52               | ..       | 36.0             | 80               |          |
| Manipay             | 4              | 6           | 5                | 17.5           | 7            | ..               | 37.4               | 9                | ..       | 28.6             | 14               | ..       | 32.4             | 46               | ..       | 29.3             | 81               |          |
| Elephant Pass       | 8              | 0           | 1                | 17.9           | 13           | ..               | 25.5               | 15               | ..       | 25.4             | 16               | ..       | 21.6             | 54               | ..       | 22.1             | 99               |          |
| Pallai              | 1              | 0           | 1                | 32.5           | 8            | ..               | 25.6               | 28               | ..       | 15.7             | 35               | ..       | 35.5             | 31               | ..       | 24.6             | 103              |          |
| Puttur              | ..             | —           | ..               | 18.3           | 3            | ..               | 7.5                | 4                | ..       | 22.0             | 2                | ..       | 39.6             | 19               | ..       | 31.5             | 28               |          |
| Vavuniya            | 5              | 8           | 17               | 19.9           | 41           | ..               | 18.8               | 25               | ..       | 39.1             | 15               | ..       | 25.8             | 92               | ..       | 22.8             | 109              |          |
| Mankulam North      | 6              | 0           | 1                | 20.6           | 5            | ..               | 21.5               | 2                | ..       | 40.9             | 6                | ..       | 23.0             | 43               | ..       | 23.5             | 57               |          |
| Kilinochchi         | 0              | 0           | 1                | 52.2           | 4            | ..               | 72.5               | 2                | ..       | 44.0             | 4                | ..       | 28.5             | 48               | ..       | 32.2             | 59               |          |
| Puliyankulam        | 3              | 0           | 1                | 33.7           | 4            | ..               | 19.6               | 7                | ..       | 21.0             | 2                | ..       | 17.7             | 26               | ..       | 19.5             | 40               |          |
| Mullaittivu         | 13             | 0           | 2                | 24.9           | 14           | ..               | 32.0               | 7                | ..       | 29.3             | 7                | ..       | 26.1             | 16               | ..       | 26.8             | 46               |          |
| Mamadu              | 18             | 4           | 5                | 30.5           | 6            | ..               | 47.0               | 4                | ..       | 37.4             | 7                | ..       | 26.2             | 31               | ..       | 29.0             | 53               |          |
| Era Periyakulam     | 30             | 8           | 5                | 20.7           | 8            | ..               | 29.0               | 7                | ..       | 36.0             | 7                | ..       | 33.8             | 24               | ..       | 31.1             | 51               |          |
| Mannar              | 21             | 0           | 16               | 32.2           | 25           | ..               | 35.3               | 21               | ..       | 36.7             | 29               | ..       | 27.2             | 108              | ..       | 29.9             | 199              |          |
| Murunkan            | 19             | 3           | 7                | 24.9           | 14           | ..               | 25.8               | 10               | ..       | 28.6             | 15               | ..       | 28.9             | 54               | ..       | 26.6             | 10               |          |
| Pesalai             | 11             | 2           | 5                | 38.4           | 10           | ..               | 22.1               | 9                | ..       | 16.6             | 8                | ..       | 20.1             | 61               | ..       | 23.7             | 93               |          |
| Tarakundu           | 13             | 9           | 8                | 34.5           | 17           | ..               | 27.1               | 10               | ..       | 17.5             | 4                | ..       | 22.7             | 61               | ..       | 24.2             | 100              |          |
| Talaimannar         | 15             | 7           | 18               | 22.1           | 16           | ..               | 15.7               | 13               | ..       | 20.71            | 3                | ..       | 34.6             | 41               | ..       | 25.3             | 101              |          |
| Puthukudi Eru       | 14             | 7           | 6                | 19.0           | 21           | ..               | 40.0               | 5                | ..       | 22.8             | 6                | ..       | 32.9             | 19               | ..       | 26.8             | 48               |          |
| Vidattitivu         | 17             | 7           | 9                | 22.3           | 7            | ..               | 15.2               | 4                | ..       | 35.8             | 7                | ..       | 34.7             | 23               | ..       | 28.5             | 50               |          |
| Adampan             | 8              | 0           | 5                | 23.6           | 9            | ..               | 18.7               | 12               | ..       | 16.5             | 17               | ..       | 24.1             | 17               | ..       | 21.8             | 126              |          |
| Madhu Road coolies  | 3              | 5           | 5                | 31.7           | 4            | ..               | 20.3               | 3                | ..       | 30.1             | 12               | ..       | 39.9             | 54               | ..       | 36.1             | 75               |          |
| Cheddikulam         | 23             | 7           | 7                | 15.6           | 21           | ..               | 5.0                | 2                | ..       | 26.6             | 6                | ..       | 30.7             | 38               | ..       | 24.7             | 74               |          |
| Anuradhapura        | 22             | 0           | 17               | 32.0           | 75           | ..               | 32.2               | 66               | ..       | 28.9             | 47               | ..       | 33.5             | 129              | ..       | 31.7             | 334              |          |
| Ratmale             | 25             | 4           | 5                | 24.0           | 14           | ..               | 36.6               | 9                | ..       | 36.3             | 7                | ..       | 33.8             | 31               | ..       | 31.8             | 66               |          |
| Mihintale           | 96             | 3           | 3                | 89.4           | 7            | ..               | 31.7               | 8                | ..       | 61.2             | 13               | ..       | 50.5             | 68               | ..       | 54.6             | 99               |          |
| Talawa              | 29             | 7           | 9                | 25.5           | 10           | ..               | 37.0               | 5                | ..       | 20.3             | 7                | ..       | 35.7             | 44               | ..       | 32.2             | 75               |          |
| Pyintukulam         | 28             | 3           | 9                | 31.3           | 9            | ..               | 24.4               | 8                | ..       | 40.4             | 7                | ..       | 37.1             | 26               | ..       | 33.6             | 59               |          |
| Tambuttegama        | 21             | 8           | 6                | 46.2           | 8            | ..               | 38.2               | 10               | ..       | 37.0             | 7                | ..       | 35.2             | 33               | ..       | 36.0             | 64               |          |
| Sampakulam          | 13             | 6           | 3                | 42.6           | 3            | ..               | 27.2               | 8                | ..       | 47.1             | 11               | ..       | 26.1             | 35               | ..       | 30.3             | 60               |          |
| Tirappane           | 24             | 0           | 2                | 29.2           | 8            | ..               | 60.0               | 4                | ..       | 34.5             | 6                | ..       | 31.7             | 32               | ..       | 33.5             | 52               |          |
| Madawachchiya       | 8              | 5           | 4                | 40.4           | 20           | ..               | 31.8               | 12               | ..       | 31.3             | 6                | ..       | 33.7             | 32               | ..       | 33.7             | 74               |          |
| Kahatagasdigiliya   | 19             | 0           | 1                | 63.2           | 4            | ..               | 33.2               | 6                | ..       | 20.5             | 12               | ..       | 27.6             | 45               | ..       | 28.9             | 68               |          |
| Kunchikulam         | 16             | 6           | 5                | 25.6           | 5            | ..               | 35.0               | 6                | ..       | 48.0             | 3                | ..       | 33.1             | 18               | ..       | 31.4             | 37               |          |
| Trincomalee Town    | 12.05          | 31          | ..               | 24.5           | 63           | ..               | 26.9               | 53               | ..       | 30.5             | 36               | ..       | 21.0             | 48               | ..       | 23.5             | 231              |          |
| Trincomalee coolies | 26             | 7           | 7                | 52.5           | 4            | ..               | 56.0               | 1                | ..       | 26.0             | 3                | ..       | 28.5             | 55               | ..       | 30.0             | 70               |          |
| Horowupotana        | 16             | 4           | 5                | 20.0           | 34           | ..               | 18.2               | 10               | ..       | 27.4             | 10               | ..       | 17.7             | 23               | ..       | 19.9             | 82               |          |
| Sinna Kinnai        | 9              | 0           | 3                | 60.0           | 25           | ..               | 47.0               | 21               | ..       | 47.6             | 8                | ..       | 43.2             | 27               | ..       | 48.4             | 84               |          |
| Muthur              | 5              | 3           | 6                | 27.8           | 41           | ..               | 42.8               | 12               | ..       | 35.3             | 13               | ..       | 28.3             | 27               | ..       | 29.2             | 99               |          |
| Topur               | 5              | 0           | 4                | 13.9           | 12           | ..               | 13.3               | 3                | ..       | 23.6             | 5                | ..       | 22.1             | 18               | ..       | 17.7             | 42               |          |
| Dampaltivu          | 9              | 2           | 9                | 25.2           | 17           | ..               | 36.3               | 6                | ..       | —                | ..               | ..       | 26.7             | 8                | ..       | 23.6             | 40               |          |
| Sally               | 7              | 5           | 8                | 22.8           | 9            | ..               | 33.3               | 9                | ..       | 23.0             | 4                | ..       | 35.7             | 11               | ..       | 25.6             | 41               |          |
| Nilaveli            | 17             | 8           | 7                | 30.4           | 17           | ..               | 47.7               | 7                | ..       | 28.0             | 1                | ..       | 62.5             | 6                | ..       | 36.3             | 38               |          |
| Peria Kinnai        | 86             | 0           | 2                | 39.7           | 36           | ..               | 44.1               | 16               | ..       | 65.9             | 8                | ..       | 32.8             | 29               | ..       | 41.5             | 91               |          |
| Tamblygama          | 29             | 6           | 22               | 20.2           | 43           | ..               | 39.8               | 7                | ..       | —                | ..               | ..       | 16.0             | 1                | ..       | 25.0             | 73               |          |

| Location.             | 3-6 Years.     |                  | 7-10 Years.    |                  | 11-14 Years.   |                  | 15-18 Years.   |                  | 19 Years and over. |                  | Average. |
|-----------------------|----------------|------------------|----------------|------------------|----------------|------------------|----------------|------------------|--------------------|------------------|----------|
|                       | Average Count. | Number examined. | Average Count.     | Number examined. |          |
| Kantalai coolies..    | —              | ..               | —              | ..               | 8·4            | 1                | ..             | 45·6             | 3                  | ..               | 23·8 48  |
| Dambulla              | 21·8           | 20               | 41·7           | 23               | 44·1           | 15               | ..             | 34·1             | 16                 | ..               | 25·8 52  |
| Minneriya             | 7·0            | 5                | 19·5           | 11               | 30·9           | 7                | ..             | 18·4             | 5                  | ..               | 35·8 164 |
| Habarana              | 13·5           | 2                | 18·6           | 3                | 22·5           | 2                | ..             | 23·0             | 5                  | ..               | 28·4 82  |
| Alutoya               | —              | ..               | —              | ..               | —              | ..               | ..             | 66·0             | 5                  | ..               | 36·7 22  |
| Polonnaruwa           | 23·6           | 5                | 34·9           | 8                | 23·2           | 5                | ..             | 25·8             | 9                  | ..               | 26·6 68  |
| Galawela              | 31·6           | 5                | 22·2           | 6                | 36·8           | 5                | ..             | 47·2             | 5                  | ..               | 31·3 44  |
| Ratmalgahala          | 28·3           | 10               | 25·5           | 11               | 17·0           | 2                | ..             | 20·4             | 10                 | ..               | 24·4 83  |
| Leandura              | 19·6           | 13               | 25·8           | 14               | 53·0           | 2                | ..             | 20·3             | 6                  | ..               | 27·7 55  |
| Thithegola            | 15·7           | 12               | 32·3           | 10               | 12·1           | 8                | ..             | 16·0             | 3                  | ..               | 32·8 37  |
| Sigiriya              | 12·5           | 8                | 22·5           | 15               | 16·5           | 4                | ..             | 23·3             | 9                  | ..               | 26·7 70  |
| Kekirawa              | —              | ..               | —              | ..               | 47·0           | 1                | ..             | 7·5              | 2                  | ..               | 23·6 9   |
| Maho                  | 15·6           | 10               | 37·2           | 13               | 32·5           | 8                | ..             | 37·1             | 8                  | ..               | 27·9 111 |
| Balalla               | 12·8           | 16               | 30·6           | 7                | 25·7           | 13               | ..             | 13·5             | 8                  | ..               | 23·5 85  |
| Nikawewa              | 27·7           | 9                | 41·2           | 13               | 29·9           | 11               | ..             | 34·9             | 9                  | ..               | 26·5 88  |
| Ehetuwewa             | 19·0           | 15               | 31·5           | 17               | 38·7           | 13               | ..             | 31·0             | 7                  | ..               | 33·2 96  |
| Nikaweratiya          | 25·0           | 1                | 23·8           | 9                | 28·6           | 8                | ..             | 44·5             | 4                  | ..               | 34·8 53  |
| Hiripitiya            | 35·7           | 6                | 23·9           | 25               | 33·2           | 5                | ..             | 33·0             | 2                  | ..               | 27·4 39  |
| Ganewatta             | 23·2           | 14               | 25·1           | 26               | 40·9           | 15               | ..             | 35·8             | 15                 | ..               | 32·9 94  |
| Galgamuwa             | 12·2           | 8                | 23·9           | 17               | 33·7           | 7                | ..             | 30·0             | 6                  | ..               | 29·0 74  |
| Polpitigama           | 21·6           | 5                | 31·4           | 7                | 32·0           | 10               | ..             | 20·8             | 6                  | ..               | 29·5 53  |
| Ampanpola             | 10·1           | 9                | 27·9           | 11               | 37·5           | 13               | ..             | 42·9             | 10                 | ..               | 37·3 92  |
| Yapawe                | 25·5           | 20               | 34·6           | 30               | 28·0           | 9                | ..             | —                | ..                 | ..               | 30·3 59  |
| Kurunegala            | 45·2           | 4                | 26·5           | 30               | 34·7           | 54               | ..             | 25·9             | 27                 | ..               | 30·4 129 |
| Kurunegala coolies    | 14·6           | 8                | 48·6           | 8                | 50·1           | 8                | ..             | 53·0             | 6                  | ..               | 49·4 75  |
| Polgahawela           | 7·2            | 4                | 26·0           | 82               | 38·1           | 40               | ..             | 28·0             | 1                  | ..               | 29·2 127 |
| Potuhera              | 19·0           | 1                | 38·5           | 24               | 34·4           | 16               | ..             | 22·0             | 1                  | ..               | 36·1 42  |
| Rambukkana            | 39·3           | 3                | 43·5           | 31               | 35·4           | 7                | ..             | 19·0             | 1                  | ..               | 42·7 48  |
| Wariyapola            | 13·0           | 1                | 26·1           | 8                | 37·0           | 5                | ..             | 31·4             | 11                 | ..               | 36·7 63  |
| Wellawa               | 10·8           | 12               | 34·5           | 17               | 38·5           | 10               | ..             | 61·9             | 7                  | ..               | 34·1 60  |
| Galagedera            | —              | ..               | 17·2           | 4                | 34·9           | 41               | ..             | 32·2             | 11                 | ..               | 34·4 70  |
| Naramulla             | 18·5           | 2                | 23·5           | 11               | 31·0           | 10               | ..             | 27·7             | 9                  | ..               | 36·3 65  |
| Muthedugalla          | 14·5           | 2                | 28·4           | 5                | 37·8           | 5                | ..             | 53·0             | 3                  | ..               | 33·2 33  |
| Giriulla              | 19·0           | 1                | 35·3           | 7                | 28·2           | 4                | ..             | 30·3             | 3                  | ..               | 32·5 42  |
| Udupola               | 4·0            | 4                | 42·2           | 4                | 22·0           | 2                | ..             | 84·0             | 1                  | ..               | 37·9 29  |
| Mawatugama            | 59·0           | 1                | 38·9           | 18               | 26·2           | 8                | ..             | —                | ..                 | ..               | 35·7 28  |
| Weuda                 | 32·3           | 3                | 48·2           | 5                | 43·6           | 8                | ..             | 46·8             | 14                 | ..               | 43·7 93  |
| Gokarella             | —              | ..               | 25·4           | 34               | 31·7           | 53               | ..             | 36·5             | 8                  | ..               | 29·3 99  |
| Chilaw coolies        | 12·3           | 3                | —              | ..               | —              | ..               | ..             | 81·0             | 1                  | ..               | 38·7 27  |
| Chilaw Town           | 6·4            | 7                | 39·2           | 50               | 30·7           | 92               | ..             | 42·5             | 60                 | ..               | 34·0 253 |
| Rajakadaluwa          | 24·8           | 14               | 17·5           | 11               | 27·8           | 4                | ..             | 32·7             | 4                  | ..               | 33·6 65  |
| Bingiriya             | 11·2           | 5                | 38·0           | 11               | 22·6           | 7                | ..             | 36·7             | 4                  | ..               | 23·6 79  |
| Madampe               | 45·0           | 6                | 24·7           | 9                | 43·1           | 6                | ..             | 29·5             | 10                 | ..               | 31·5 89  |
| Dandegamuwa           | 25·2           | 18               | 19·7           | 9                | 32·2           | 4                | ..             | 39·3             | 6                  | ..               | 25·7 70  |
| Kuliyapitiya          | 7·1            | 8                | 58·4           | 18               | 29·1           | 8                | ..             | 25·7             | 4                  | ..               | 25·6 69  |
| Hettipola             | 53·5           | 4                | 24·4           | 33               | 54·3           | 19               | ..             | 22·0             | 1                  | ..               | 36·0 62  |
| Kochchikade           | 28·5           | 2                | 44·0           | 1                | —              | ..               | ..             | 25·2             | 10                 | ..               | 28·1 39  |
| Lunuwila              | 26·5           | 2                | 41·9           | 20               | 21·3           | 7                | ..             | 9·0              | 1                  | ..               | 36·1 40  |
| Bolawatta             | 26·6           | 10               | 27·4           | 38               | 33·2           | 10               | ..             | 25·3             | 7                  | ..               | 27·9 65  |
| Mahakandura           | 7·1            | 8                | 17·5           | 18               | 19·2           | 4                | ..             | 35·1             | 9                  | ..               | 19·4 88  |
| Negombo               | 11·9           | 25               | 24·7           | 18               | 33·7           | 12               | ..             | 37·1             | 17                 | ..               | 27·1 169 |
| Marawila              | 68·7           | 10               | 29·5           | 2                | 36·0           | 2                | ..             | —                | ..                 | ..               | 61·6 23  |
| Mundel                | 42·3           | 11               | 42·3           | 18               | 46·4           | 8                | ..             | 89·2             | 6                  | ..               | 52·8 80  |
| Puttalam              | 22·1           | 12               | 30·6           | 62               | 37·0           | 33               | ..             | 25·8             | 5                  | ..               | 34·6 139 |
| Maradankuli           | 25·0           | 1                | —              | ..               | —              | ..               | ..             | —                | ..                 | ..               | 28·1 24  |
| Do. coolies           | 58·5           | 2                | 25·2           | 8                | 21·7           | 6                | ..             | 39·4             | 7                  | ..               | 48·8 57  |
| Palavi village        | —              | ..               | 24·7           | 4                | 28·5           | 2                | ..             | —                | ..                 | ..               | 24·3 13  |
| Palavi coolies        | —              | ..               | 37·0           | 3                | 29·3           | 3                | ..             | 41·1             | 7                  | ..               | 35·1 33  |
| Manpuri Fishers..     | 9·9            | 9                | 17·7           | 19               | 36·6           | 8                | ..             | 46·0             | 3                  | ..               | 23·3 88  |
| Sellankandal          | 48·0           | 3                | 26·0           | 3                | 34·5           | 2                | ..             | 21·3             | 3                  | ..               | 46·1 24  |
| Tonigala coolies..    | 22·0           | 1                | 18·2           | 4                | —              | ..               | ..             | 28·0             | 1                  | ..               | 33·3 36  |
| Anamaduwa             | 9·0            | 1                | 40·7           | 23               | 32·0           | 11               | ..             | 90·5             | 2                  | ..               | 38·6 60  |
| Etalai                | 9·0            | 4                | 18·0           | 3                | 25·6           | 5                | ..             | 56·0             | 1                  | ..               | 25·9 34  |
| Siyambalawa           | 8·5            | 2                | 21·8           | 5                | 14·9           | 8                | ..             | 11·7             | 6                  | ..               | 20·7 59  |
| Murukwattume          | 26·0           | 2                | 23·0           | 5                | 12·6           | 5                | ..             | 22·3             | 3                  | ..               | 31·3 41  |
| Kalpitiya             | 13·0           | 4                | 74·0           | 3                | —              | ..               | ..             | —                | ..                 | ..               | 23·5 27  |
| Average for the above | 21·9           | ..               | 30·1           | ..               | 31·6           | ..               | ..             | 32·2             | ..                 | ..               | 30·7     |

N.B.—Average count indicates the average number of parasites harboured by the number examined.

## Island-survey : Egg-count—Worm-count.

|                           | Number of Persons. | Average. |                         | Number of Persons. | Average. |  |  |
|---------------------------|--------------------|----------|-------------------------|--------------------|----------|--|--|
| <i>Dimbula Area.</i>      |                    |          |                         |                    |          |  |  |
| Holbrook*                 | 100                | 9.0      | Padiyapallala†          | 93                 | 13.5     |  |  |
| Diyagama Group*           | 101                | 8.7      | Maturata†               | 68                 | 12.0     |  |  |
| Glenlyon*                 | 10                 | 5.2      | Hanguranketa†           | 7                  | 8.9      |  |  |
| St. Clair*                | 102                | 9.3      | <i>Uda Pussellawa.</i>  |                    |          |  |  |
| Lamaliere*                | 71                 | 10.5     | Waldemar*               | 186                | 16.8     |  |  |
| Lindoola*                 | 52                 | 5.9      | Delmar*                 | 66                 | 14.7     |  |  |
| Kattookelle*              | 39                 | 5.10     | Eskadale*               | 76                 | 17.3     |  |  |
| Talawakele*               | 69                 | 5.2      | Gracelyn*               | 100                | 12.3     |  |  |
| Troup*                    | 40                 | 5.8      | Blair Lomond*           | 158                | 28.5     |  |  |
| Kowlahena*                | 35                 | 6.0      | Amherst*                | 28                 | 24.6     |  |  |
| Talawakele (Bazaar)       | 25                 | 5.8      | Brookside*              | 16                 | 14.7     |  |  |
| Holbrook†                 | 86                 | 5.10     | Kirklees*               | 77                 | 17.4     |  |  |
|                           |                    |          | Uda Pussellawa†         | 48                 | 22.5     |  |  |
| <i>Maturata District.</i> |                    |          |                         |                    |          |  |  |
| Marigold*                 | 198                | 13.2     | <i>Dikoya District.</i> |                    |          |  |  |
| Gonakelle*                | 100                | 16.3     | Ottery*                 | 100                | 20.5     |  |  |
| Hight Forest*             | 90                 | 15.4     | Osborne*                | 100                | 20.1     |  |  |
| Ellamulla*                | 100                | 20.2     | Roseera*                | 100                | 24.5     |  |  |
| Mahacoodagala*            | 107                | 8.5      | Dikoya*                 | 17                 | 27.4     |  |  |
| Silverkandy*              | 18                 | 8.9      | Fetteresso*             | 59                 | 23.8     |  |  |
| Hanguranketa*             | 99                 | 19.2     | Glencairn*              | 50                 | 34.9     |  |  |

\* Estate.

† Village.

## TREATED AREA.

## Homagama : Interval — Months.

| Age.              | Occupation.  | Number of Treatments. |                | One Treatment. |                | Two Treatments. |                | Three Treatments. |                |
|-------------------|--------------|-----------------------|----------------|----------------|----------------|-----------------|----------------|-------------------|----------------|
|                   |              | Examined.             | Average Count. | Examined.      | Average Count. | Examined.       | Average Count. | Examined.         | Average Count. |
| 0-4               | —            | 4                     | 0              | 2              | 3              | 3               | 0              | —                 | —              |
| 5-6               | —            | 7                     | 13.6           | 5              | 3.6            | 6               | 4              | —                 | —              |
| 7-10              | —            | 8                     | 13.9           | 18             | 6.8            | 70              | 2.5            | —                 | —              |
| 11-14             | —            | 10                    | 28.6           | 16             | 13.5           | 45              | 4.6            | —                 | —              |
| 15-18             | —            | 24                    | 39             | 11             | 21.5           | 60              | 9.8            | —                 | —              |
| 7-18 (Additional) | —            | 250                   | 36.7           | 475            | 11.8           | —               | —              | —                 | —              |
| 19 and over       | Cultivators  | 121                   | 36.7           | 80             | 31.3           | 248             | 11.3           | —                 | —              |
| Do.               | Traders      | —                     | —              | —              | —              | —               | —              | —                 | —              |
| Do.               | Coolies      | —                     | —              | —              | —              | 1               | 6              | —                 | —              |
| Do.               | Shoe-wearers | —                     | —              | 1              | 9              | —               | —              | —                 | —              |
| Average           |              | 424                   | 35.5           | 608            | 14.3           | 441             | 8.8            | —                 | —              |

## Siyane Korale East and West : Interval 11 Months.

|             |              |       |      |     |      |     |       |    |      |
|-------------|--------------|-------|------|-----|------|-----|-------|----|------|
| 0-4         | —            | 131   | 8.8  | 8   | 1.2  | 9   | 6.7   | —  | —    |
| 5-6         | —            | 104   | 15.8 | 38  | 9.2  | 13  | 7.5   | —  | —    |
| 7-10        | —            | 131   | 21   | 109 | 14.7 | 131 | 13.5  | 8  | 9    |
| 11-14       | —            | 72    | 26.6 | 78  | 18.8 | 126 | 14.5  | 10 | 10.4 |
| 15-18       | —            | 71    | 31.5 | 59  | 23.4 | 107 | 19.3  | 11 | 14   |
| 19 and over | Cultivators  | 564   | 68.4 | 292 | 32.7 | 539 | 25    | 11 | 12   |
| Do.         | Traders      | 27    | 46.3 | 7   | 24.3 | 18  | 21.8  | 1  | 56   |
| Do.         | Coolies      | 18    | 54.3 | 3   | 26.3 | 17  | 26.9  | 2  | 17.5 |
| Do.         | Shoe-wearers | 2     | 70   | —   | —    | 1   | 22    | —  | —    |
| Average     |              | 1,120 | 45.2 | 594 | 24.6 | 961 | 20.10 | 43 | 15.2 |

## Hapitgam Korale or Mirigama North : Interval 13 Months.

|             |              |     |      |     |      |     |      |    |      |
|-------------|--------------|-----|------|-----|------|-----|------|----|------|
| 0-4         | —            | 16  | 15.9 | 2   | 1.5  | —   | —    | —  | —    |
| 5-6         | —            | 14  | 18.3 | 3   | 19.7 | —   | —    | —  | —    |
| 7-10        | —            | 35  | 27.8 | 26  | 18.8 | 37  | 23.4 | 4  | 12.2 |
| 11-14       | —            | 10  | 34.7 | 15  | 23   | 38  | 17.4 | 9  | 19   |
| 15-18       | —            | 7   | 39.7 | 11  | 19.2 | 30  | 15.3 | 8  | 22   |
| 19 and over | Cultivators  | 110 | 53.5 | 81  | 25.4 | 176 | 24.3 | 56 | 28.9 |
| Do.         | Traders      | —   | —    | 1   | 50   | 6   | 16   | 2  | 71.5 |
| Do.         | Coolies      | 5   | 84.4 | 3   | 16.7 | 10  | 15   | 3  | 22   |
| Do.         | Shoe-wearers | 1   | 34   | —   | —    | —   | —    | 2  | 41   |
| Average     |              | 198 | 43.2 | 142 | 22.9 | 297 | 21.9 | 84 | 27.4 |

## Mirigama South : Interval 22 Months.

|             |             |     |      |     |      |     |      |     |      |
|-------------|-------------|-----|------|-----|------|-----|------|-----|------|
| 0-4         | —           | 17  | 34.9 | 1   | 38   | 3   | 4    | 5   | 0    |
| 5-6         | —           | 32  | 24.7 | 26  | 31.3 | 70  | 19.2 | 5   | 12.6 |
| 7-10        | —           | 55  | 40.7 | 46  | 25.4 | 152 | 18   | 19  | 24.6 |
| 11-14       | —           | 24  | 36.2 | 12  | 27.7 | 114 | 19.2 | 21  | 18.7 |
| 15-18       | —           | 27  | 47.3 | 13  | 19   | 111 | 22.2 | 22  | 17.9 |
| 19 and over | Cultivators | 222 | 46.8 | 87  | 33   | 533 | 23.5 | 158 | 16.3 |
| Do.         | Traders     | 15  | 42.4 | 1   | 66   | 6   | 13.3 | 7   | 20   |
| Do.         | Coolies     | 5   | 45   | 1   | 13   | 8   | 35.6 | 10  | 38.7 |
| Average     |             | 397 | 42.8 | 187 | 29.7 | 997 | 21.7 | 247 | 17.8 |

## Triangular : Interval 27 Months.

| Age. | Occupation. | Number of Treatments. |                | One Treatment. |                | Two Treatments. |                | Three Treatments. |                |
|------|-------------|-----------------------|----------------|----------------|----------------|-----------------|----------------|-------------------|----------------|
|      |             | Examined.             | Average Count. | Examined.      | Average Count. | Examined.       | Average Count. | Examined.         | Average Count. |

|             |              |     |      |     |      |     |      |     |      |
|-------------|--------------|-----|------|-----|------|-----|------|-----|------|
| 0-4         | ..           | 77  | 9.3  | 1   | 0    | 1   | 22   | —   | ..   |
| 5-6         | ..           | 80  | 24   | 16  | 22.2 | 7   | 33.3 | 4   | 10   |
| 7-10        | ..           | 86  | 18.6 | 69  | 10.8 | 74  | 15   | 17  | 9.1  |
| 11-14       | ..           | 45  | 26.5 | 70  | 14.4 | 85  | 12.6 | 26  | 12.7 |
| 15-18       | ..           | 42  | 25.3 | 47  | 16.2 | 109 | 13.4 | 45  | 12.6 |
| 19 and over | Cultivators  | 262 | 39   | 173 | 20.1 | 523 | 17   | 188 | 19.4 |
| Do.         | Traders      | 22  | 32.9 | 8   | 21.5 | 19  | 21   | 4   | 28.2 |
| Do.         | Coolies      | 5   | 22.6 | 5   | 16   | 26  | 14.5 | 7   | 10.3 |
| Do.         | Shoe-wearers | —   | —    | 2   | 18.5 | 1   | 34   | —   | —    |
|             | Average      | 622 | 28.3 | 392 | 16.9 | 855 | 15.9 | 291 | 15.9 |

## Siyane Korale West : Interval 27 Months.

|             |              |     |      |     |      |     |      |    |      |
|-------------|--------------|-----|------|-----|------|-----|------|----|------|
| 0-4         | ..           | 50  | 9.7  | 4   | 11   | —   | ..   | —  | ..   |
| 5-6         | ..           | 56  | 21.8 | 11  | 7.5  | —   | ..   | —  | ..   |
| 7-10        | ..           | 88  | 27.4 | 39  | 13.6 | 31  | 16   | 3  | 6    |
| 11-14       | ..           | 24  | 38   | 28  | 20.8 | 40  | 15   | 2  | 7    |
| 15-18       | ..           | 25  | 37.7 | 25  | 19.1 | 27  | 23.2 | 4  | 6.2  |
| 19 and over | Cultivators  | 207 | 56.8 | 135 | 33.3 | 142 | 27   | 13 | 16.9 |
| Do.         | Traders      | 41  | 55.5 | 7   | 31.7 | 16  | 32.6 | 1  | 6    |
| Do.         | Coolies      | 2   | 33   | 2   | 14   | 1   | 28   | —  | —    |
| Do.         | Shoe-wearers | 1   | 28   | 1   | 56   | 1   | 41   | —  | —    |
|             | Average      | 494 | 40.7 | 252 | 25.9 | 258 | 23.9 | 23 | 12.6 |

## Minuwangoda : Interval 33 Months.

|             |              |     |      |     |      |     |      |    |      |
|-------------|--------------|-----|------|-----|------|-----|------|----|------|
| 0-4         | ..           | 27  | 3.5  | 1   | 38   | 1   | 28   | —  | ..   |
| 5-6         | ..           | 25  | 18.1 | 4   | 12.5 | 11  | 13.6 | 5  | 19.8 |
| 7-10        | ..           | 40  | 23.4 | 16  | 8.9  | 27  | 10.8 | 4  | 9.5  |
| 11-14       | ..           | 21  | 32.8 | 18  | 14.1 | 35  | 12.6 | 10 | 11   |
| 15-18       | ..           | 19  | 19.7 | 31  | 18.7 | 41  | 12.4 | 8  | 17   |
| 19 and over | Cultivators  | 120 | 35.4 | 82  | 21.5 | 215 | 19.4 | 46 | 22.7 |
| Do.         | Traders      | 6   | 46.3 | 1   | 3    | 10  | 19   | —  | ..   |
| Do.         | Coolies      | 7   | 30.9 | —   | —    | 28  | 20.9 | 19 | 20.5 |
| Do.         | Shoe-wearers | —   | —    | 1   | 13   | 1   | 16   | 1  | 9    |
|             | Average      | 265 | 27.5 | 154 | 18.4 | 369 | 17.4 | 93 | 19.6 |

## Summary.

|  |             | First Treatment. | Second Treatment. | Total.    |
|--|-------------|------------------|-------------------|-----------|
| Total treatments given in the Homagama area by Unit No. 1, January to December, 1924   | ..          | 29,964           | 21,163            | 51,127    |
| Total treatments given in the Peradeniya area by Unit No. 2, January to May, 1924  | ..          | 8,677            | 4,242             | 12,919    |
| Total treatments given in the Matale area by Unit No. 2 (estates), June to August, 1924  | ..          | 9,914            | 113               | 10,027    |
| Total treatments given in the Dimbula area by Unit No. 2 (estates), September to December, 1924  | ..          | 20,378           | —                 | 20,378    |
| Total treatments given in the Mirigama-Minuwangoda-Veyangoda area by Half Unit No. 3 (attached to No. 2), June to August, 1924             | ..          | 280              | —                 | 280       |
| Total treatments given in the Mahara area by Half Unit No. 4, January to May, 1924   | ..          | 5,165            | 5,069             | 10,234    |
| Total treatments given in the Jaffna peninsula (itinerating) by Half Unit No. 4, September to December, 1924                               | ..          | 35,977           | —                 | 35,977    |
| Total treatments given in the Western Province (itinerating) by Half Unit No. 4, September to December, 1924                               | ..          | 107              | —                 | 107       |
| Total treatments given in the Weligama area by Half Unit No. 5, September to December, 1924  | ..          | 7,805            | 3,972             | 11,777    |
| Total treatments given in the northern half of the Island (itinerating), July to October, and Uda Pussellawa estates, November to December | ..          | 4,890            | —                 | 4,890     |
| Total treatments given by Central Office, January to December, 1924  | ..          | 113              | 35                | 148       |
|  |             | 123,270          | 34,594            | 157,864   |
| Reports from dispensers itinerating controlled by Central Office, January to December, 1924  | ..          | 18,088           | 6,115             | 24,203    |
| Estate treatments by Director, March to April, 1924  | ..          | 4,633            | —                 | 4,633     |
|  | Total       | 145,991          | 40,709            | 186,700   |
| Government Hospitals and Dispensaries  | ..          | 776,913          | —                 | 980,905   |
| Estate treatments (estimated)  | ..          | 50,000           | —                 | 50,000    |
|  | Grand Total | 972,904          | —                 | 1,217,605 |
| Province of Sabaragamuwa, report received February 18, 1925  | ..          | 6,308            | —                 | 7,551     |
|  |             | 979,212          | —                 | 1,225,156 |

23. *Tubercular Diseases of the Lungs.*—The number of hospital cases treated during the year was 3,656 with 860 deaths, as against 4,099 cases with 990 deaths in 1923, 3,308 cases with 865 deaths in 1922, 3,353 cases with 881 deaths in 1921, and 2,870 cases with 660 deaths in 1920.

The provincial distribution of hospital cases treated in 1923 and in 1924 was as under:—

|                           | 1923.  |         | 1924.  |         |
|---------------------------|--------|---------|--------|---------|
|                           | Cases. | Deaths. | Cases. | Deaths. |
| General Hospital, Colombo | 550    | 257     | 585    | 226     |
| Lunatic Asylum, Colombo   | 119    | 54      | 96     | 18      |
| Western Province          | 2,124  | 355     | 1,968  | 381     |
| Central Province          | 250    | 85      | 206    | 61      |
| Northern Province         | 58     | 11      | 53     | 11      |
| Eastern Province          | 61     | 17      | 35     | 8       |
| Southern Province         | 335    | 29      | 242    | 40      |
| North-Western Province    | 178    | 53      | 76     | 20      |
| North-Central Province    | 35     | 10      | 25     | 6       |
| Province of Uva           | 120    | 32      | 93     | 22      |
| Province of Sabaragamuwa  | 267    | 87      | 277    | 67      |
| Railway Extensions        | 2      | —       | —      | —       |
|                           | 4,099  | 990     | 3,656  | 860     |

The Western Province cases include patients from all the Provinces who come to Colombo, Kandana, and Ragama for treatment. The percentage of deaths to total treated during the year was 23.52, and the Registrar-General's return gives a total of 3,235 deaths, as against 24.15 and 3,322 respectively the previous year. Three special institutions—the Anti-Tuberculosis Institute, Colombo; the Kandana Sanatorium, Western Province, for early cases; and the Ragama Tuberculosis Hospital, Western Province, for advanced and chronic cases—are maintained to deal with this disease, and a large number are treated in the tuberculosis wards of the General Hospital, Colombo.

*At the Institute in Colombo.*—The number of new cases was 3,312, as compared with 3,565 in 1923, 3,000 in 1922, 2,785 in 1921, and 2,196 in 1920. Of the cases seen during the year, 812 were referred to the hospital at Ragama and 216 to the sanatorium at Kandana, and the others attended the institute for medicine and advice.

*At the Kandana Sanatorium.*—200 cases were admitted (121 males and 79 females), and these with 55 remaining on December 31, 1923, made a total of 255 cases treated during the year—222 from the Western Province, 11 from the Southern, 8 from the Central, 4 from the Northern, 4 from the North-Western, 3 from Uva, 2 from Sabaragamuwa, and 1 from North-Central Province. Of the total number treated, 212 were discharged or left the sanatorium of their own accord and 43 remained on December 31, 1924. There were no deaths. The average duration of stay in hospital of each patient during the year was 70.36 days of those discharged, in 32 the disease was arrested, 45 were reported as improved and 45 as much improved, in 90 there was no improvement.

*At the Ragama Hospital for Chronic Cases* (235 beds for males and 103 for females).—The total number of patients admitted during the year was 1,062, of which 25 were readmissions, and the total number of deaths 288. The daily average sick in hospital for the year was 308.6.

In 49 patients the disease was arrested, and they were transferred to Kandana for sanatorium treatment.

Two new wards were completed during the year, and it is hoped the old wards will be reconstructed on modern lines in the coming year.

24. *Leprosy.*—Two asylums are maintained in the Island for the segregation of lepers under the Lepers Ordinance, No. 4 of 1901—at Hendala in the Western Province and the island of Mantivu in the Eastern Province. They are nursed by Religious Sisters with the help of male and female attendants at both asylums.

There were 114 lepers at Mantivu island on December 31, 1923. Forty-eight were admitted during the year, 12 died, 31 were discharged or absconded, and 119 remained on December 31, 1924. Of the admissions, 14 were new cases, 31 readmissions, and 3 absconders from the Hendala Asylum. The daily average in the asylum during the year was 112.95, and the percentage of deaths 7.41.

The report of the Medical Superintendent in charge of the asylum at Hendala gives the following figures for the year under review:—

|                               |    |    |    |     |
|-------------------------------|----|----|----|-----|
| Remained on December 31, 1923 | .. | .. | .. | 516 |
| Admitted during 1924          | .. | .. | .. | 135 |
| Discharged                    | .. | .. | .. | 77  |
| Died                          | .. | .. | .. | 51  |
| Remained on December 31, 1924 | .. | .. | .. | 523 |

Of the 135 admissions 110 were new cases; and of these, 9 were of the tubercular type, 29 of the anaesthetic type, and 72 of the mixed type. The new admissions were from the following Provinces:—Western 62, Central 12, Southern 14, Northern 6, North-Western 3, Sabaragamuwa 6, and Uva 7.

Of the 77 patients discharged from the asylum, 6 were granted permit for home isolation, 17 Indian Tamils were repatriated to India, and 54 absconded. Of the absconders, 25 returned of their own accord or were taken back by the police and 29 are still at large. The percentage of deaths to total number of inmates in the asylum was 7.83, as against 9.89 the previous year.

The Medical Superintendent reports 146 lepers were treated during the year with E C C O, 3 of these were discharged cured in October last, many of the younger subjects under treatment who have been regular have shown marked improvement, and if this regularity is maintained still better results can be expected in the near future.

There has been steady progress in the early cases under this treatment, and there are a number of patients now in the asylum whose discharge as cured will soon have to be considered. The majority are, however, in the last stage of the disease and of the advanced crippled nerve type, and these can only hope for some relief, some improvement in their general health from this treatment.

25. *Parangi (Framboesia, or Yaws).*—The number of hospital admissions was 6,149 with 18 deaths, as against 9,748 admissions with 32 deaths in 1923. The decrease in the number of admissions to hospitals during the year was due to intensive campaigns by seven Itinerating Medical Officers in the Central, Southern, Eastern, North-Western, North-Central, Uva, and Sabaragamuwa Provinces, and the treatment of a large number of out-patients brought by headmen to and voluntarily seeking treatment at dispensaries and the out-patient departments of hospitals.

The distribution of the disease judged from hospital returns is shown in the following table:—

|                           | 1921. | 1922.  | 1923. | 1924. |
|---------------------------|-------|--------|-------|-------|
| General Hospital, Colombo | 267   | 306    | 436   | 445   |
| Western Province          | 1,096 | 1,499  | 770   | 485   |
| Central Province          | 1,202 | 1,312  | 1,194 | 911   |
| Northern Province         | 157   | 102    | 504   | 367   |
| Eastern Province          | 749   | 791    | 646   | 404   |
| Southern Province         | 1,093 | 5,085  | 2,672 | 1,123 |
| North-Western Province    | 711   | 784    | 645   | 400   |
| North-Central Province    | 374   | 594    | 696   | 584   |
| Province of Uva           | 684   | 594    | 731   | 370   |
| Province of Sabaragamuwa  | 1,841 | 2,221  | 1,741 | 1,058 |
| Railway Extensions        | —     | —      | 11    | 2     |
|                           | 8,161 | 13,545 | 9,748 | 6,149 |

The dispensary cases as regards Provinces were as follows:—

|          | 1923. | 1924. | 1923.         | 1924.  |
|----------|-------|-------|---------------|--------|
| Western  | 3,393 | 2,701 | North-Western | 12,254 |
| Central  | 2,942 | 2,812 | North-Central | 19,185 |
| Northern | 866   | 818   | Uva           | 1,871  |
| Eastern  | 5,050 | 4,066 | Sabaragamuwa  | 2,397  |
| Southern | 8,501 | 6,006 |               | 13,023 |
|          |       |       |               | 17,748 |
|          |       |       |               | 1,011  |
|          |       |       |               | 2,051  |

The seven Itinerating Medical Officers treated a total number of 17,852 cases, and a large number of these patients attended a second and a third time, and 33,052 injections were given during the campaign in 1924, as against 16,815 cases and 30,139 injections in 1923.

Dr. J. A. E. Corea, a private practitioner, visited Kanjukkulia, Hettipola, and Bingiriya in the Chilaw District, and treated 147 cases of parangi during the year with drugs supplied by Government.

26. *Plague.*—There were 153 cases (Colombo town 148, Kalutara 1, Talaimannar 1, Peliyagoda near Colombo 1, and Talawakele bazaar 2) during the year with 145 deaths, as against 232 cases with 211 deaths in 1923, 160 cases with 150 deaths in 1922, 187 cases with 171 deaths in 1921, and 369 cases with 316 deaths in 1920. Of the 153 cases reported, 59 males and 12 females were admitted to the Infectious Diseases Hospital, Colombo, 62 were bubonic, 7 septicæmic, and 2 pneumonic. The septicæmic and the pneumonic cases proved fatal, and of the total number of cases treated during the year 19.2 per cent. recovered, as against 15.68 per cent. recovered the previous year.

27. *Port Health Precautions.*—During the year 2,584 British and foreign steamers and 297 native sailing vessels called at the port of Colombo and were inspected, as against 2,363 steamers and 285 sailing crafts in 1923 and 2,323 and 281 respectively in 1922.

Six steamers arrived infected and were placed in strict quarantine; of these, 3 arrived with smallpox, 1 with cholera, 1 with cerebro-spinal fever, and 1 with typhus. All the cases were landed and sent to the Infectious Diseases Hospital. Seven cases of chickenpox were landed during the year.

Of the samples of water taken from the water boats and sent for analysis only two were condemned, and necessary action immediately taken to have the boats cleaned and cementwashed.

The number vaccinated during the year was 5,963, mostly arrivals from India *via* Tuticorin.

Disinfection of 152,934 persons and their clothing was carried out at the port disinfecting station, as against 146,206 the previous year.

At the port venereal clinic for seamen 61 cases of syphilis were treated by intravenous injections in 1924, 68 in 1923, and 82 in 1922.

### SECTION III.—THE SANITARY BRANCH OF THE MEDICAL DEPARTMENT.

28. The following report for the year is submitted by Dr. S. T. Gunasekera, Acting Sanitary Commissioner:—

*Training Class.*—A class for the training of Sanitary Inspectors was started in April with 42 students. The course of instruction lasted 6 months, at the end of which the qualifying examination was held. At the end of the course there were only 36 students in the roll, 6 having dropped out for various reasons during the period of training.

The course of instruction is both theoretical and practical; the former by lectures and the latter by daily field work under Sanitary Inspectors in the suburbs of Colombo, by demonstrations, by attendance at Police Court accompanied by Sanitary Inspectors to learn procedure in conducting sanitary prosecutions. Tuition in each subject is given by a member of the staff of the Sanitary Branch, with the exception of lectures and demonstrations on insect carriers of disease. Mr. H. F. Carter, the Malariaologist, kindly consented to continue his course of instruction on this subject.

Monthly examinations are held during the course of training, and students who do not show satisfactory progress are discontinued. A fairly high standard of knowledge is necessary for a pass in the qualifying examination and every attempt is made to ascertain the suitability of each candidate to carry out the difficult duties of a Sanitary Inspector, which requires tact and common sense in addition to special knowledge.

Thirty-five students qualified for appointment as Sanitary Inspectors. Of this number, 10 were appointed by this Branch during 1924.

*Sanitary Inspectors.*—Twenty-one Sanitary Inspectors were appointed during the year and were posted to various stations.

*Distribution of Staff.*—The following officers are stationed in Colombo:—The Sanitary Commissioner; Assistant Sanitary Commissioner; the two Medical Officers of Health of the Western Province (excluding Kalutara District); Medical Officer of Health, Railways; two Probationary Medical Officers of Health; Sanitary Engineer; and Sanitary Superintendent. Dr. Chellappah was attached to the Head Office for special work in connection with the sanitation of Moratuwa, the Pearl Fishery, &c. The Medical Officer of Health, Central Province, has his headquarters at Kandy, and the Medical Officer of Health in charge of Kalutara District and Southern Province is stationed at Kalutara.

The total number of Sanitary Inspectors on the staff was 141, distributed as follows:—

|                          |    |    |                        |    |     |
|--------------------------|----|----|------------------------|----|-----|
| Western Province         | .. | 74 | North-Western Province | .. | 3   |
| Southern Province        | .. | 18 | Province of Uva        | .. | 2   |
| Central Province         | .. | 15 | Railway Sanitation     | .. | 8   |
| Northern Province        | .. | 7  |                        |    |     |
| Province of Sabaragamuwa | .. | 6  |                        |    | 138 |
| Eastern Province         | .. | 5  |                        |    |     |

The three Supervising Inspectors were stationed in the Western Province and Central Province; two on the former and one in the latter.

The rat gang has been working in the following suburbs of Colombo:—Cotta, Wellampitiya, Waragoda, Peliyagoda, Nugegoda, Dehiwala, Mount Lavinia. In addition, the services of the gang were lent to the Urban District Council, Negombo, for a short period.

*Summary of Work done.*—During the year 391,617 premises were inspected, of which 97,887 were found insanitary and necessary action was taken.

5,395 prosecutions were entered for breaches of sanitary rules and regulations, and 3,865 convictions were obtained. The fines recovered amounted to Rs. 13,403.50. 16,880 notices were served calling upon householders to remedy sanitary defects; in the case of 13,107 of these the requirements of the notices were voluntarily complied with, while in the case of the rest persuasion was required.

In the following table the work done during the year is compared with that of the preceding year:—

|   |    | 1923.         | 1924.         |
|---|----|---------------|---------------|
| Number of premises inspected  | .. | 300,214       | 391,617       |
| Number of premises found insanitary   | .. | 68,919        | 97,887        |
| Number of prosecutions entered for breaches of sanitary rules and regulations | .. | 3,693         | 5,395         |
| Amount of fines realized  | .. | Rs. 10,451.95 | Rs. 13,403.50 |
| Number of notices served to remedy sanitary defects                           | .. | 15,653        | 16,880        |
| Number of notices voluntarily complied with                                   | .. | 8,622         | 13,107        |

*Sanitary Conveniences: Public Latrines.*—During the financial year 1923-24, 22 public latrines were built by Local Boards and Sanitary Boards throughout the Island. The location of the latrines is as follows:—

|                   |    |   |                        |    |   |
|-------------------|----|---|------------------------|----|---|
| Western Province  | .. | 2 | North-Western Province | .. | 2 |
| Southern Province | .. | 5 | North-Central Province | .. | 2 |
| Central Province  | .. | 5 | Eastern Province       | .. | 3 |
| Northern Province | .. | 3 |                        |    |   |

Government contributed a sum of Rs. 30,000 towards the cost of the above. It is regretted that a sum of Rs. 8,744.98 lapsed to revenue owing to local bodies to which allocations had been made not being able to utilize the money within the financial year.

*Private Latrines.*—The number of private latrines built during the year in each Province is as follows:—

| Province.     |       | Pit.   | Dry-earth. | Total. |
|---------------|-------|--------|------------|--------|
| Western       | ..    | 15,390 | 1,058      | 16,448 |
| Southern      | ..    | 2,057  | 31         | 2,088  |
| Central       | ..    | 765    | 359        | 1,124  |
| Sabaragamuwa  | ..    | 448    | 94         | 542    |
| North-Western | ..    | 24     | 32         | 56     |
| Uva           | ..    | 27     | 21         | 48     |
| Northern      | ..    | 18     | 62         | 80     |
| Eastern       | ..    | —      | 3          | 3      |
|               | Total | 18,729 | 1,660      | 20,389 |

*Buildings, New and Reconstructed.*—In all 2,640 building applications were dealt with, and plans for 984 new buildings were approved of as conforming to requirements of Housing Ordinance. The largest number of applications was from small towns of the Western Province.

*Infectious Diseases.*—The following infectious diseases were reported to this department, which took necessary action in regard to prevention:—

|               |    |       |          |    |     |
|---------------|----|-------|----------|----|-----|
| Chickenpox    | .. | 1,834 | Mumps    | .. | 30  |
| Diphtheria    | .. | 2     | Phthisis | .. | 116 |
| Dysentery     | .. | 1,086 | Plague   | .. | 16  |
| Enteric fever | .. | 963   | Smallpox | .. | 29  |
| Measles       | .. | 934   | Cholera  | .. | 17  |

These cases have been reported only from the Western, the Southern, the Central, the Northern, and Sabaragamuwa Provinces.

*Dysentery.*—There has not been any unusual prevalence of this disease during 1924, and the total number of cases reported shows a decrease in its incidence in comparison with the previous year. Most of these reported cases were from the Western and Southern Provinces. Except for the mild outbreak at Akuressa, in Matara District, the disease did not assume any serious epidemic form. The village of Akuressa and those bordering on the Nilwala-ganga are subjected to periodical floods, and as a result the shallow unprotected wells, which form the source of water supply to the bulk of the inhabitants, become polluted, thus leading to the spread of all intestinal diseases. Unusually heavy rains occurred last year, leading to a rise of the level of sub-soil water and surface pollution of the wells, and people drinking water both from the river that was in flood and these unprotected shallow wells contracted the disease. Extreme poverty, poor housing conditions, combined with utter ignorance of sanitary principles played a considerable part in the spread of the disease. Prompt action was taken by the Medical Officer of Health, Kalutara ; a Sanitary Inspector was detailed for special duty in the infected area, and the outbreak was brought to an end in a short time.

*Plague.*—Of 16 cases that were reported, 15 occurred in the Western Province and 1 in the Galle District. Although this shows an increase on the number reported in the previous year, all these were sporadic cases, and the infection was traced to Colombo.

All precautionary measures were promptly adopted in each instance, and no further cases occurred.

*Cholera.*—In all 17 cases were reported, 5 of which occurred in the early part of the year at Kahawatta, a village in the Southern Province. Two of these 5 cases ended fatally. The source of infection of the first case could not be ascertained, but the rest were most likely cases of contact infection, as neither food nor water could be incriminated.

Two outbreaks occurred in the last quarter of the year in the Province of Uva, the first being in the Kandehena estate at Naimunukula, and the other in the villages of Demodera and Uduwera. In each of these outbreaks a Medical Officer of Health and Supervising Sanitary Inspector were detailed for special duty. At Naimunukula there occurred 3 cases with 2 deaths, and at Demodera and Uduwera 5 cases with 4 deaths. All precautionary measures were adopted, and the outbreaks were checked before they could assume serious proportions.

Two cases were reported from Rye estate, Balangoda, in the Province of Sabaragamuwa, 1 case from the village of Dodanduwa, in the Southern Province, and 1 case from Pussellawa, in the Central Province. All these were sporadic cases, and all precautionary measures having been taken against the spread of the disease no further cases occurred. In none of the outbreaks was the original source of infection definitely traced.

*Smallpox.*—Except for the epidemic of smallpox at Jaffna and the villages around it, there were reported only 3 sporadic cases from the whole Island, 2 of which were in the Western Province and 1 in the Central Province.

The epidemic at Jaffna occurred about the middle of October, and began with a case in the village Evanai. From there the disease spread to other areas, but as the infected area was not very large it was not considered necessary to proclaim the area under the Quarantine and Prevention of Diseases Ordinance.

The total number of cases that occurred in this epidemic is 26, of which 5 proved fatal. A Medical Officer of Health with 7 Sanitary Inspectors and several disinfecting orderlies were detailed for special duty in infected area. All precautionary measures, including wholesale vaccination of the contacts and residents of the infected area, were adopted to stamp out the outbreak. Considerable difficulty was experienced at the beginning in getting people to undergo vaccination, but persuasion and tact on the part of the Sanitary Officers ultimately got over the difficulty and there was no further obstruction of any sort.

Much of the value of the preventive steps taken was lost, due to concealment and non-notification of cases in the beginning, and it was only after legal action was taken and heavy punishment inflicted by the court in 2 cases that those malpractices ceased.

Ignorance of the seriousness of this infectious disease, poverty, and the tendency to conceal cases, combined with the difficulties arising out of social customs, especially amongst Muslims, favoured the spread of the disease by contact infection. However, the timely arrival of the Medical Officer of Health with the Sanitary Staff, and removal of cases to the Infectious Diseases Hospital and contacts to the segregation camp ensured proper isolation, which could not otherwise be obtained under the housing conditions in which these people live. Early detection of cases by daily house-to-house visits, isolation of patients, and segregation of contacts, coupled with universal vaccination, prevented the epidemic from assuming an alarming size.

The epidemic was mostly confined to the administrative limits of the Urban District Council of Jaffna and a few villages around it. It lasted for about 6 weeks. The various localities that constituted the infected area in this epidemic are Evanai, Thaddateru, Kotady, Sudumalai, Saravanai, Kaladdy, Moor street, Naval, Kokuvil. Vaccination was carried on extensively in this outbreak both amongst people in the infected locality and those in villages bordering on them, including the school children in various public institutions. School children of 11 such institutions were vaccinated, and in the infected locality the total number vaccinated was 8,256. This preventive step was ably carried out by eleven vaccinators, two of whom were women.

In the absence of any legislation in regard to revaccination a good many cases of obstruction had to be faced, mostly amongst the Muslims, who refused to be vaccinated. This matter was forthwith brought to the notice of the Government Agent, who proceeded with the Medical Officer of Health to the spot ; his presence had the desired effect ; and the people readily agreed to vaccination.

*Enteric Fever.*—This disease appears to have prevailed to a greater extent than in the previous years, 963 cases having been reported as against 709 in 1923. The greater prevalence of the disease is attributable to the same contributory causes as in the case of dysentery. The almost continuous wet weather, combined with heavy floods that occurred last year, played a considerable part in the incidence of the disease. The unsatisfactory housing conditions amongst the poorer classes rendered effective home isolation impossible. The long duration of this disease, inadequate home isolation, and insanitary methods of disposal of excreta lead to the spread of the disease by contact infection.

The endemic centres of this disease are the principal towns of the Western and the Southern Provinces, and outbreaks of varying severity occur from time to time in and around these centres.

Three such outbreaks occurred in the Western Province this year. The first one took place at the Gampaha Orphanage, with 7 cases and 2 deaths. This is an institution where annual visitations of typhoid and dysentery occur owing to insanitary conditions prevailing therein which detract from its value as an orphanage. An unprotected water supply, lack of drainage, want of adequate and proper sanitary conveniences are matters to which the attention of the managing authority has repeatedly been invited with hardly any effect, and the result is that the orphanage is a potential source of infection for these infective bowel disease. The orphanage is immediately outside the Sanitary Board limits of Gampaha.

The second outbreak occurred at Ambepussa. This originated in a case of typhoid fever that was removed from the above orphanage to this place. Altogether 11 cases with 2 deaths occurred, and the spread of the disease was attributable to inadequate isolation and contact infection.

The third outbreak occurred at Okadawatta, Mount Lavinia. The total number of cases in this outbreak is 10 with 3 deaths. The exact source of infection in the first case of this outbreak could not be determined, but the cause of spread was attributable to contact infection. The inhabitants of this area are the cooly and artisan class, and live under very-insanitary and bad housing conditions. It is a common practice amongst these classes for friends and relations to pay frequent visits in case of illness, and when death occurs to partake of food offered as alms in the infected house itself, and possibly in contaminated vessels, thus spreading the infection broadcast.

Measures adopted in this outbreak included inoculation of residents in the area in addition to the usual preventive steps. The salutary effect of this procedure in reducing the case incidence was very appreciable, as will be evident on comparison with a similar outbreak in the same place in 1920, when anti-typhoid inoculation on an extensive scale could not be carried out owing to the opposition of the people, resulting in a total case incidence of 83, as against 10 in the outbreak in the year under review.

*Disposal of Human Excreta.*—In Local Board towns and in the larger Sanitary Board towns, the dry-earth system of conservancy is in force. The night soil in these towns is either trenched or incinerated. Incinerators have been installed in several towns in the Central Province, and attempts are being made for similar installations in some towns of the Western Province also. This would not only obviate the difficulty that is often experienced in connection with selection and proper maintenance of trenching grounds, but also remove the disadvantages associated with unsatisfactory disposal by dumping of house refuse.

In the Western Province the dry-earth system is gradually replacing the pit latrines, and this work has been considerably extended; 1,660 pail latrines having been constructed, as against 1,206 in the previous year.

The chief obstacle to the introduction of the dry-earth system is the inability on the part of the majority of householders to meet the monthly conservancy fee, which usually is Re. 1. The Sanitary Board town of Ambalangoda, in the Southern Province, is the sole instance where latrines are conserved free, the assessment rate being slightly increased to cover expenses. If this could be imitated by other Sanitary Board towns, especially where majority of the people are found to be comparatively poor, the initial expense of constructing the latrine will be readily undertaken by the householders and the dry-earth system will be uniformly in evidence in all the towns.

*Scavenging.*—Arrangements are in force in the various Local Board and Sanitary Board towns throughout the Island for the collection and disposal of domestic and public refuse. In the majority of these towns scavenging is done on contract and considerable supervision has to be exercised for efficient working thereof.

As pointed out in previous reports, the dumping of refuse and its use as manure for grass fields or coconut plantations, especially within town areas or their vicinity, is insanitary, owing to breeding of flies, which invariably occurs in these places. This in its turn leads to an increase in the incidence of fly-borne diseases, which are so common in Ceylon. It would, therefore, be preferable to dispose of this refuse by incinerators, and this method is recommended for adoption, as has already been done in several towns of the Central Province with success. It will be a matter for regret if the more progressive Western Province should continue to lag behind the Central Province in this respect, the more so as fly-borne diseases are endemic in the Western Province.

*Domestic Water Supplies.*—During the year 51,075 wells were inspected. Of these, 26,556 were found to be unprotected and liable to pollution and 1,575 wells were improved.

The sooner the provision is made for a pipe-borne supply of pure water to the Local Board and larger Sanitary Board towns, the better will be the health of these towns.

Forty-nine samples of water were examined chemically by the Government Analyst and 8 samples bacteriologically by the Director, Bacteriological Institute, at the request of the Sanitary Commissioner.

Of the samples examined, 37 were found unfit for drinking purposes, and suitable action was taken to improve the source of supply.

*Licensed Trades.*—A stricter application of the regulations for controlling licensed trades has been made upon them this year. In the cases of old-standing licensed trades a course of gradual improvement is insisted upon, and each year brings them closer to the full requirements of the by-laws. However, in the case of new ones, licence is withheld till all the requirements of by-laws have been complied with.

The Suburban Dairies and Laundries Ordinance is now applicable to all the Local Board and Sanitary Board towns, but only a few towns have taken advantage of this measure to get dairies supplying them with milk improved. The Ordinance has to be amended in certain important respects in order to give its provisions full effect, and this matter is at present under consideration.

There is still a large number of unlicensed laundries in the suburbs of Colombo, but it is almost impossible to prove that they wash for the city, and consequently no legal action can be taken. However, an increasing number of applications for laundry licence is received, and when essential requirements have been complied with licence is recommended.

The following is a statement of applications for licences dealt with by Sanitary Inspectors in Western, Southern, Central, Eastern, Uva, Sabaragamuwa, Northern, and North-Western Provinces:—

|                                     | Number of Applications. |              |                  |
|-------------------------------------|-------------------------|--------------|------------------|
|                                     | Received.               | Recommended. | Not Recommended. |
| Bakeries ..                         | 343                     | 286          | 57               |
| Tea and coffee boutiques ..         | 930                     | 840          | 90               |
| Eating-houses ..                    | 229                     | 208          | 21               |
| Public galas ..                     | 56                      | 47           | 9                |
| Manure stores ..                    | 26                      | 23           | 3                |
| Soap manufactories ..               | 3                       | 2            | 1                |
| Hide stores ..                      | 1                       | 1            | —                |
| Lime kilns ..                       | 25                      | 25           | —                |
| Brick kilns ..                      | 48                      | 46           | 2                |
| Dairies ..                          | 69                      | 47           | 22               |
| Cabook quarries ..                  | 11                      | 10           | 1                |
| Plumbago sheds ..                   | 4                       | 4            | —                |
| Metal quarries ..                   | 9                       | 9            | —                |
| Public bathing places ..            | 1                       | 1            | —                |
| Kraals for soaking coconut husks .. | 23                      | 23           | —                |
| Fibre dyeing ..                     | 1                       | 1            | —                |
| Butcher stalls ..                   | 89                      | 77           | 12               |
| Fish stalls ..                      | 34                      | 31           | 3                |
| Pork stalls ..                      | 8                       | 8            | —                |
| Fibre mills ..                      | 19                      | 18           | 1                |
| Desiccating mills ..                | 11                      | 10           | 1                |
| Aerated water manufactories ..      | 10                      | 9            | 1                |

*Milk Supply.*—166 samples of milk were examined by the Government Analyst, at the request of the Sanitary Commissioner, of which 109 were found to be adulterated. The adulteration usually consisted in the addition of water, and the percentage of added water varied from 7 per cent. to 79 per cent. Offenders were prosecuted and punished, and fines amounting to Rs. 1,792.50 recovered.

With the passing of the Suburban Dairies and Laundries Amendment Ordinance of 1922, powers have been obtained in towns proclaimed under it for punishing unlicensed dairymen from outside the town areas supplying milk to the town. It is often found difficult to prove sale of milk by these vendors from outside the town areas and consequently no conviction can be secured. This illicit vending of milk can only be stopped if people refuse to buy milk from unlicensed vendors. Even if the various Local Boards and Sanitary Boards in the Island enforce the Ordinance in their towns and thus improve the dairies and the local milk supply, unless people will cease to trade with unlicensed vendors the business of the latter will continue, as they undersell the licensed vendor. In the case of areas outside Board towns, where action can only be taken under the Nuisance Ordinance of 1862, it is required to prove that water added to the milk sample was *in itself* noxious before a conviction can be secured, and hence sale of milk in rural areas cannot be controlled.

*Town Planning and Improvements.*—Besides his routine duties, the Sanitary Engineer of the Department carried out the following works for the various Sanitary Boards :—

Detail surveys and plans thereof were prepared for Jambugasmulla (Nugegoda district), about 75 acres ; part of Kalubowila East, about 100 acres.

A scheme of roads for part of Kirillapone was devised and one road was laid out.

Levels and sections were taken for drainage of swamps and proposed medial road ( $\frac{1}{4}$  mile) at Dehiwala between canal and Station road.

Type plans were prepared of (a) public latrine for dry districts ; (b) urinal for Batticaloa ; (c) mound latrine.

Models in wood were designed for (a) conservancy cart ; (b) refuse cart ; (c) mound latrine ; (d) public latrine ; (e) commode (with automatic shutters). The models themselves were made under his supervision.

Specifications and estimates were made for all the type plans of the Department.

In addition to the above, the Sanitary Engineer delivered 16 lectures on Sanitary Engineering to the Sanitary Learners' Class.

*Sanitary Propaganda.*—Lantern lectures on general sanitation were delivered by the Sanitary Superintendent at the following places :—

One at Kurunegala Town Hall under the auspices of the Kurunegala Social Service League.

One at Weligama Wesleyan Mission School in connection with the inauguration of the ancylostomiasis campaign in Weligam korale, Southern Province.

One open air lecture at the Hakgalla Agricultural Show.

The Supervising Sanitary Inspector, Kalutara, delivered a number of lectures in Weligam korale in connection with the pre-sanitation campaign there.

*Public Health Exhibitions.*—Public health sections were opened at the Kandy Agri-Horticultural Show and the Hakgalla Agricultural Show in Siyane korale east. The exhibits consisted of models of sanitary appliances, posters, diagrams, &c., conveying information on sanitary matters, live and mounted specimens of mosquitoes, their larvae and pupae, charts, diagrams, and maps showing the prevalence and distribution of malaria in the Island ; eggs, larvae and pupae of the house-fly, charts illustrating its life cycle, and an exhibit demonstrating the method it contaminates food.

At the request of the Sanitary Commissioner the Director of the Hookworm Campaign in Ceylon sent a representative to the Kandy Show, and his exhibits consisting of live and preserved specimens of hook and other intestinal parasites, charts, and posters of hookworm patients before and after treatment, and the various drugs used in hookworm treatment were also housed in the sanitary section. Leaflets in English and the vernaculars on the causation and prevention of disease were freely distributed.

These exhibits attracted the attention of a large number of visitors, managers, principals, and teachers of schools, school children, and various officers engaged in public health work were interested in the exhibits. Villagers were given free access to the show, where everything was minutely explained to them in Sinhalese and Tamil.

The following new models have been prepared and added to the stock during the year :—Models of a refuse cart, conservancy cart, mound latrine, dry-earth closet with self-closing seat, and a public latrine without roof for use in the dry zones. All the models of the department are now displayed in a special room in the annexe to this office and are demonstrated to sanitary students and interested visitors.

*Training of Village Headmen in Sanitation.*—In connection with ancylostomiasis campaigns, Sanitary Training Classes for Police Headmen were held in Hewagam korale, Colombo District, and Weligam korale in Matara District by the Sanitary Superintendent. Forty-five Police Headmen and 11 outsiders attended the course of training in Hewagam korale, and 32 headmen and 9 outsiders passed the examination. Ten headmen who obtained over 80 per cent. marks were given monetary rewards with a certificate, and 22 headmen and the 9 outsiders who obtained over 40 per cent. marks were awarded certificates. The certificates and rewards were awarded at the Homagama Government School, where the class was held, by the Sanitary Commissioner and the Assistant Government Agent.

A class for 100 headmen was started during December, 1924, at Weligama and is still in progress.

Type plans prepared by this Department are in increasing demand, and have been supplied to many local bodies, who follow them in their new constructions.

*Ancylostomiasis Campaigns.*—The Hewagam korale campaign, which was started in September, 1923, is still in progress, and the work is nearing completion. Two out of the 11 Inspectors stationed there for pre-sanitary work were withdrawn, the villages in their charge being handed over to neighbouring Inspectors.

*Mawanella-Kadugannawa Campaign.*—The treatment campaign was brought to a close early in the year under review. Out of the 7 special Sanitary Inspectors stationed, 4 have been withdrawn.

*Weligam Korale Campaign.*—In anticipation of the proposed ancylostomiasis campaign which was started in September, 1924, an area comprising 36 villages was taken up for pre-sanitary work. Six Inspectors were stationed during March, 1924, and the work is still in progress.

*Miscellaneous.*—During the year under review the following special reports were submitted by officers of the Department:—

- (1) Report on the Sanitation of Nuwara Eliya, by the Sanitary Commissioner, made at the request of His Excellency the Governor.
- (2) Report on Negombo Prison, by the Assistant Sanitary Commissioner, at the request of the Inspector-General of Prisons.
- (3) Report on Insanitary Dwellings in Negombo, by Dr. M. de Costa, Medical Officer of Health, at the request of the Chairman, Urban District Council, Negombo.
- (4) Reports on 12 sites for burial grounds by Medical Officers of Health, at the request of Government or Government Agents.
- (5) Reports by Medical Officers of Health on 26 sites for public latrines throughout the Island.

*Model By-laws.*—The Sanitary Commissioner drafted a set of model by-laws for the control of licensed premises at the request of the Chairman, Local Government Board. These by-laws are being considered by the Board.

*Sanitation in the Kalutara District of the Western Province and in the Southern Province.*

*Statistical Return of the Routine Work.*—

|   |    |    |              |
|---|----|----|--------------|
| Number of premises inspected ..                           | .. | .. | 92,695       |
| Number of premises found insanitary ..                    | .. | .. | 23,555       |
| Number of nuisance notices served ..                      | .. | .. | 4,510        |
| Number of prosecutions entered ..                         | .. | .. | 833          |
| Number of convictions obtained ..                         | .. | .. | 584          |
| Number discharged ..                                      | .. | .. | 224          |
| Amount of fines realized ..                               | .. | .. | Rs. 1,592.00 |
| Number of mosquito breeding places detected ..            | .. | .. | 2,093        |
| Number of buildings constructed and under construction .. | .. | .. | 112          |
| Number of building applications dealt with ..             | .. | .. | 575          |
| Number of galas inspected ..                              | .. | .. | 17           |
| Number of bakeries ..                                     | .. | .. | 127          |
| Number of eating-houses ..                                | .. | .. | 77           |
| Number of tea boutiques ..                                | .. | .. | 168          |
| Number of offensive trades ..                             | .. | .. | 222          |
| Number of aerated water factories ..                      | .. | .. | 2            |
| Number of latrine notices served ..                       | .. | .. | 11,682       |
| Number of latrines, dry-earth, built ..                   | .. | .. | 243          |
| Number of latrines, pit, built ..                         | .. | .. | 5,960        |
| Number of latrines, dry-earth, under construction ..      | .. | .. | 105          |
| Number of latrines, pit, under construction ..            | .. | .. | 4,559        |
| Number of prosecutions entered ..                         | .. | .. | 2,953        |
| Amount of fines realized ..                               | .. | .. | Rs. 2,589.60 |

*Buildings.*—Those within the limits of the Sanitary Board are controlled by the Housing Ordinance, No. 19 of 1915, and the Small Towns Ordinance, No. 18 of 1892. In all 575 applications have been dealt with, 112 new buildings have been constructed, and 112 improved upon; 81 buildings have been reported as insanitary and dangerous for occupation.

*Water Supply.*—The chief source of water supply is the well. River water is also used for drinking and bathing purposes, especially in the villages that border on the rivers Kalu-ganga, Gin-ganga, Nilwala-ganga. Instructions were issued for boiling water from the river and from unprotected wells before it was used for drinking purposes. In the year under review 44 wells were built and improved upon.

*Conservancy and Disposal of Excreta.*—In Sanitary Board towns this is done by coolies on contract under the supervision of the Sanitary Inspector, and in rural areas, where dry-earth latrines exist, the work is done under the supervision of the Village Committees. The usual method of disposal of excreta in all these cases is by trenching in sites selected for the purpose. In Dodanduwa and Hikkaduwa it used to be buried in the beach near the public latrines, but late in the year two sites were selected and trenching is being done there since. The old trenching ground at Ambalangoda was completely used up, and a temporary site in the adjoining land is now being used for trenching the night soil. A new site will soon be necessary as the adjoining land is insufficient.

The trenching ground at Wadduwa will soon be sick with night soil. As a single site is not enough to cope with the increased number of buckets, an additional site has been selected to the north of the town, and arrangements have also been made to extend the present site to the south.

*Scavenging.*—In the Sanitary Board towns this is done on contract system, while in the villages coolies do the work under the supervision of the Village Committees. Sweepings are either used for reclaiming low-lying lands owned by the Boards or the Village Committee, or disposed of by dumping on land selected for the purpose. Owing to want of a by-law for the compulsory provision of standard dust bins, traders and householders are indifferent towards the proper disposal of refuse, which in most cases is unsatisfactorily carried out.

*Drainage.*—No drainage work has been undertaken in the year under review, although there is much work to be done in this respect. Improvements suggested in my last report have not been effected yet, and they are urged again. Drains are urgently required at Alutgama, Wadduwa, Agalawatta, Tebuwana, Neboda, Beruwala, Hikkaduwa, Dodanduwa, and Dondra. Drains are also needed for important bazaar areas in rural centres. Most of the earth drains in the villages are covered with weeds and grass, and this condition exists in some of the Sanitary Board towns also.

At Weligama there is a piece of low-lying land on the south of the Railway approach road covered with stagnant rain water almost throughout the year. This area should be drained, or if funds disallow such an undertaking, be reclaimed by dumping the Board sweepings on this land and covering the same with earth. Steps should also be taken to deal with the borrow pits holding stagnant water and breeding mosquitoes along the railway lines in the Kalutara, Matara, and Galle Districts, particularly those that are close to important railway stations, such as Weligama, Ahangama, and Matara.

*Latrine Construction.*—This has made greater progress in the rural areas than in the towns. This is due, not so much to the inability on the part of the residents to meet the initial outlay in construction of the latrines, as to the payment of the regular monthly fees for conservancy, which is regarded as a great hardship. The result is that the work of latrine construction has made very slow progress in towns in spite of prosecution and fines. But if the Boards undertake to conserve latrines free of charge, as obtains in the town of Ambalangoda, there will be a ready response from the poorer people also, and latrine construction in towns will show the same progress as in the villages.

|  |       |
|--|-------|
| Total number of latrines constructed, dry-earth .. ..        | 243   |
| Total number of latrines constructed, pit .. ..              | 5,960 |
| Total number of latrines under construction, dry-earth .. .. | 105   |
| Total number of latrines under construction, pit .. ..       | 2,953 |

*Infectious Disease.*—The following cases of infectious diseases were reported by Sanitary Inspectors in this area, and necessary action was taken to prevent their further spread:—

|                     | Cases. | Deaths. |
|---------------------|--------|---------|
| Dysentery .. ..     | 642    | 68      |
| Plague .. ..        | 10     | 10      |
| Cholera .. ..       | 5      | 2       |
| Enteric fever .. .. | 419    | 111     |
| Chickenpox .. ..    | 713    | —       |
| Measles .. ..       | 19     | 1       |
| Mumps .. ..         | 16     | —       |

I have already commented on the incidence of dysentery, plague, and cholera.

*Enteric Fever.*—This disease was prevalent throughout the year in almost all parts of the Province. It has been more or less endemic in certain centres, such as Wadduwa, Tantirimulla, Horana, Alubomulla, Maggona, Dodanduwa, and Ambalangoda. The total number of cases reported was 419 with 111 deaths, of which 186 cases with 69 deaths and 63 cases with 13 deaths were contributed by the Panadure and Kalutara Districts respectively. All necessary precautions were taken, and special measures were adopted where necessary. Antityphoid inoculation was carried on amongst the contacts wherever they were found willing to be inoculated.

Six prosecutions were entered for not reporting cases of infectious disease, and in each case a conviction was obtained.

*Chickenpox.*—713 cases were reported. Thirty-three persons were prosecuted for failing to report to the proper authority the occurrence of cases of this disease, and 28 convictions were obtained.

*Public Markets.*—No new markets have been built during this year, but those in existence have been maintained in a fair state of repair by the Sanitary Board or the Village Committee responsible.

Markets in the following towns were improved:—Horana, Neboda, and Gandara.

Repairs and improvements are needed for the markets in the following places:—Alutgama, Beruwala, Maggona, Hikkaduwa, Dodanduwa, and Dondra.

*Public Latrines.*—Four new latrines with separate compartments for males and for females have been built at Dodanduwa, Hikkaduwa, and Ahangama in the Galle District.

A public latrine is very desirable at Maggona market; there is no such convenience attached to the railway station either, and the market, which is well patronized, is only 50 feet from it. There is room available for this purpose in the Railway land behind the market. Should one be built, it will serve the public visiting both the railway station and the market.

*Licensed Trades.*—Those within Sanitary Boards are governed by regulations framed under Small Towns Ordinance, No. 18 of 1892, while those in villages in the Kalutara District are controlled by regulations framed under Ordinance No. 15 of 1862. The trade premises in the rural areas of Matara and Galle Districts are without adequate sanitary control, nevertheless they are being regularly inspected, and persuasion is being brought to bear upon owners to improve the existing conditions. The improvements effected in these areas have so far been limited to general cleansing and whitewashing, but the more important requirements have been totally ignored, and cannot be enforced until such time as the necessary regulations are in force. New trade premises have been opened, and are being run without proper control. It is therefore apparent that early steps should be taken to bring these under control by introducing suitable by-laws.

An additional set of by-laws dated February 6, 1924, has been passed for Matara District also, but though these insist upon a licence, they do not fully deal with the situation. A set of comprehensive by-laws is therefore necessary here at an early date.

#### *Licensed Trades Inspected.*—

|  |     |
|--|-----|
| Bakeries .. ..                                 | 127 |
| Eating-houses .. ..                            | 77  |
| Butcher stalls .. ..                           | 16  |
| Tea boutiques .. ..                            | 168 |
| Kraals .. ..                                   | 180 |
| Pork stalls .. ..                              | 26  |
| Galas .. ..                                    | 17  |
| Manure stores .. ..                            | 5   |
| Quarries .. ..                                 | 6   |
| Briek kilns .. ..                              | 14  |
| Lime kilns .. ..                               | 14  |
| Aerated water factories .. ..                  | 2   |
| Plumbago sheds .. ..                           | 3   |
| Notices served for breach of regulations .. .. | 186 |
| Prosecutions .. ..                             | 69  |
| Convictions .. ..                              | 61  |

*Milk Supply.*—One striking feature in regard to milk supply of the area is that, although milk is sold freely and in abundance in all parts of the district, both within the Boards and in rural areas, not a single dairy has been licensed. It is also surprising how these dairymen have consistently escaped detection by Inspectors and continued to profit on illicit vending of milk. A few seizures of samples of milk have been made at random in some centres, and in one case, namely, at Weligama, adulteration was found to be as gross as 60 per cent. Five samples were analysed and four vendors were prosecuted and a conviction obtained in each case.

In the Matara District the situation is worse, and no improvements are possible owing to absence of any by-laws regarding sale and supply of milk. The by-laws for Galle District have provided the necessary powers, and steps are being taken to enforce them.

In anticipation of a campaign of treatment against ancylostomiasis a pre-sanitation campaign was started in March at Weligama korale in the Matara District. Further particulars are given elsewhere. The work is still in progress.

#### *Sanitation in the Central Province.*

*Water Supply.*—The water supply of all the Local Board towns, except Nawalapitiya, continues to be inadequate and unsatisfactory. Schemes have been formulated in certain towns, such as Gampola, Hatton, and Matale, but so far they have not materialized.

The town of Gampola, with a population of over 6,000, has to manage with a supply that was provided when its population was about half that number. The supply is therefore utterly inadequate, and the condition of its drains, which cannot be flushed owing to want of water, is a disgrace. A scheme to provide an adequate supply of water has been prepared and funds are available, but for some reason or other no further progress has been made. The Medical Officer of Health of the Province considers that the provision of an adequate water supply to Gampola is the most urgent sanitary need of the Province, and I agree with him.

At Nawalapitiya the supply has been increased by laying a 6-inch intake pipe from the catchment area to the reservoir, and it is now ample and satisfactory.

Schemes have been devised to improve and increase the water supply in the following Sanitary Board towns:—Palapatwala, Madawela, Rattota, Kadugannawa.

The water supply of the following towns, which is from wells, is inadequate and unsatisfactory, and no active steps have so far been taken to augment or improve it:—Ulapone, Kandapola, Ragala, Mailapitiya, Panwila, Wattegama, Pussellawa, Holbrook, Pundaluoya.

Considering the ease with which it is possible owing to natural conditions to provide pipe-borne water for towns in the Central Province, early steps should be taken to carry out schemes already prepared and devise others to provide adequate supplies to all the towns in this Province. A good and adequate supply of water is an essential sanitary requirement, and its provision should receive priority over all other measures to improve a town.

*Scavenging and disposal of Refuse.*—Arrangements for scavenging have been the same as in the preceding year. At Lindula the Board has engaged its own coolies to carry out the work, as it was not satisfactorily done by the estate coolies.

The scavenging work has been generally well carried out in the towns. At Gampola steps have been taken to ensure better scavenging by increasing the number of coolies and carts. Also an effort has been made to get all householders to provide covered bins for storing refuse for removal, and during the year a large number of bins was thus provided. In Nuwara Eliya District the old custom of providing large communal bins for the bazaar area has been done away with and private individual bins introduced instead.

*Disposal of Refuse.*—The refuse is disposed of by tipping or burning in an incinerator. During the year new incinerators have been built at the following places:—Kadugannawa, Dikoya, Talawakele (additional one), Ragalla, and Nanu-oya. Incinerators have been recommended and approved for Panwila and Teldeniya, and sites have been selected for them. Funds have been provided in the Estimates for 1925 for incinerators at Madawela, Kaudupelella, and Palapatwala. Although funds have been provided for building an incinerator at Maskeliya, the work has yet not been done.

The statement below shows the method of disposal of refuse in the various Local Board and Sanitary Board towns:—

|                                     |    | Tipping. | Incinerators. |
|-------------------------------------|----|----------|---------------|
| Local Board towns                   | .. | ..       | 1 .. 3        |
| Kandy District Sanitary Board towns | .. | ..       | 6 .. 6        |
| Nuwara Eliya Sanitary Board towns   | .. | ..       | 1 .. 11       |
| Matale Urban District Council       | .. | ..       | 4 .. 2        |
|                                     |    | 12       | 22            |

*Conservancy and Disposal of Excreta.*—New public latrines have been constructed at the following places:—Dambulla 1, Kotagala 2, Tillicoultry 1.

All the towns except Mailapitiya have dry-earth public latrines. In the poorer and backward towns, such as Kaudupelella, Aluvihare, Palapatwala, Dambulla, and Mailapitiya, private latrines are, with a few exceptions, pits. In towns where dry-earth conservancy is in force, and where people can pay the conservancy charges dry-earth private latrines are installed.

*Disposal of Night Soil.*—The disposal in all towns is by trenching. During the year trenching grounds have been acquired and put in use at Ulapone and Panwila. Proper trenching grounds are required for Talawakele, Pussellewa, Maskeliya, and Norwood. In some towns trenching is being done either in tea or in waste land near the latrines, and this is found unsatisfactory. Proper trenching grounds should be acquired for these towns also.

*Latrine Accommodation.*—During 1924 the new constructions in the Local Board and Sanitary Board towns were—

|                  |    |    |  |
|------------------|----|----|--|
| Public latrines  | .. | .. | .. Pail, 22 seats                      |
| Private latrines | .. | .. | .. Pail, 131 seats<br>.. Pit, 40 scats |

In my reports for the years 1922 and 1923 attention was drawn to the fact that several estates owning bazaar areas in Sanitary Board towns had not provided latrine accommodation for their tenants. I suggested that the local authority should take necessary action to enforce the powers granted by law for safeguarding public health. As nothing had been done, this unsatisfactory state of affairs was brought to the notice of

Government, and as a result a resolution was passed by the Kandy Sanitary Board that the Board should give the estates concerned 2 months' time to erect latrines, at the expiry of which legal steps were to be taken in case of non-compliance. Action was taken on these lines, and the estates concerned have complied with the requirements of notices issued on them.

The following estates have built latrines in the towns mentioned against each of them :—

|                      |    |    |    |               |
|----------------------|----|----|----|---------------|
| Devon and Mt. Vernon | .. | .. | .. | Dimbula       |
| Glentilt             | .. | .. | .. | Maskeliya     |
| Kotiyagala           | .. | .. | .. | Bogawantalawa |
| Vedahetta            | .. | .. | .. | Galaha        |
| Melfort              | .. | .. | .. | Pussellawa    |

Plans have been submitted to owners of Huluganga and Wattegama for construction of private latrines, and in the case of the former work has already been started. Public latrines have been built at Kotagala and Tillicoultry.

*Latrines in Local Board Towns.*—At Gampola necessary improvements have been effected to the public latrines, but the progress made with regard to building of private latrines is unsatisfactory. This has been mostly due to the desire of the authorities not to enforce building of dry-earth latrines unless they were satisfied that the parties could afford to pay conservancy fees. A more enlightened policy is necessary in this respect for this large and thickly populated town where soil pollution is very common. The small monthly fee should be regarded as an insurance against infective bowel diseases, particularly hookworm infestation, which is markedly prevalent in this important centre of a planting district employing immigrant Indian labour.

*Hatton.*—It is not possible to build private latrines owing to the high bank at the back of the buildings. The Local Board should, therefore, provide more public latrines.

*Dikoya.*—Very few private latrines exist in this town, 99 per cent. of people depending on the public latrines ; existing latrine accommodation is therefore inadequate, and the Medical Officer of Health, Central Province, submitted a report to the Board recommending that the estate owning the town should be asked to build 7 latrines for their tenants.

*Drainage.*—Extensions to the existing drains have been effected to the following places:—Tillicoultry, Pundaluoya, Padiyapelella, Ragala, and Wattegama.

Back drainage has been provided to several houses in following towns:—Holbrook, Dimbula, Hanguranketa, Padiyapelella, Kandapola, Galaha, Bogawantalawa.

At Nawalapitiya a stimulus has been given to the building of roadside drains by the carrying out of the modified improvement scheme of the town.

At Gampola the work of improving the drains has been started and fair progress made ; when finished it will be a great improvement to the town.

New lengths of drains have been built along several streets ; however, without an adequate water supply the cleansing of the drains will be impossible, and they may prove to be a source of nuisance.

*Licensed Trades.*—The following is a list of licensed premises in the Province :—

|                          |    |     |    |                             |    |    |
|--------------------------|----|-----|----|-----------------------------|----|----|
| Eating-houses            | .. | ..  | 67 | Aerated water manufactories | .. | 3  |
| Tea and coffee boutiques | .. | 358 |    | Common lodging houses       | .. | 1  |
| Bakeries                 | .. | ..  | 59 | Maldivine fish stores       | .. | 7  |
| Fish stalls              | .. | ..  | 31 | Brick and lime kilns        | .. | 12 |
| Mutton stalls            | .. | ..  | 18 | Dairies                     | .. | 12 |
| Beef stalls              | .. | ..  | 34 | Manure stores               | .. | 4  |
| Galas                    | .. | ..  | 19 |                             |    |    |

Considerable improvements have been effected in trade premises, especially bakeries and tea boutiques. The want of a proper meat stall is keenly felt at Maskeliya, Pussellewa, Kadugannawa, and Talawakele. On completion of new markets at these places meat will only be sold at properly-built sanitary stalls. Except at Nawalapitiya and Matale, fish stalls are owned privately and are unsatisfactory.

*Public Markets.*—A new market has been built for Wattegama. Public markets are very necessary for the following places, and steps should be taken to expedite the completion of those in hand and to begin the erection of those for which sites have been selected and approved:—Maskeliya, Pussellawa, Kadugannawa, Talawakele, and Gampola.

*Granaries.*—The rat-proof granaries at Matale and Nawalapitiya have not been put into use. Local bodies are awaiting the model by-laws that are being drafted by the Attorney-General regarding storing of grain. In the meantime Matale and Nawalapitiya have passed their own by-laws prohibiting sale of imported rice except in rat-proof buildings or bins. These by-laws will be enforced in 1925.

*Public Galas and Cattle Sheds.*—With the increasing use of motor transport considerable reduction has taken place in the number of the galas in this Province. There has also been a great deal of improvement effected to the existing ones. At Dikoya, Dimbula, and Talawakele insanitary cattle sheds and galas still continue to exist. The attention of the local authorities has been drawn to the need for improving them without delay.

*Milk Supply and Dairies.*—During the year the requirements of the Suburban Dairies and Laundries Ordinance have been enforced regarding dairies in the various towns of this Province except Matale. A large number of dairies outside the towns and from which milk is brought into the towns have been licensed. In the Kandy District, where the Sanitary Board was not in favour of enforcement of the Ordinance, the necessity of having some supervision over the milk supply was pointed out, and recommendations were made by the Medical Officer of Health, Central Province, whereby the requirements regarding the dairies may be gradually enforced. His recommendations were that all regular milk vendors who sell milk in the town should be licensed, and that licence should be granted if the water supply and the premises are generally satisfactory, although the other requirements are not strictly complied with. In the meantime an effort is to be made by the Sanitary Inspectors to get gradual improvements effected to the dairy premises so as to bring them up to the requirements. Strict enforcement of the Ordinance, it was suggested, should be made in 1925, so that only those that satisfied the requirements or made honest attempts to do so should be licensed. In most of the towns there are a sufficient number of licensed dairymen.

Greater activity has been manifested during the year in dealing with sale of adulterated milk in towns outside local areas as will be seen from the figures given below:—

Towns :—

|  |    |    |           |
|--|----|----|-----------|
| Number of samples examined ..          | .. | .. | 149       |
| Number of samples found adulterated .. | .. | .. | 75        |
| Number prosecuted ..                   | .. | .. | 73        |
| Fines realized ..                      | .. | .. | Rs. 1,239 |

Outside towns :—

|                                  |    |    |         |
|----------------------------------|----|----|---------|
| Number of samples seized ..      | .. | .. | 26      |
| Number of samples adulterated .. | .. | .. | 16      |
| Number prosecuted ..             | .. | .. | 16      |
| Fines realized ..                | .. | .. | Rs. 370 |

*Infectious Diseases.*—The following cases of infectious diseases were notified by the Inspectors of this Department :—Measles 148, chickenpox 239, dysentery 18, enteric 14, smallpox 1, cholera 1.

The increase in figures of the less serious infectious diseases this year is due to the fact that, unlike the previous years, these figures include those that were reported to the Provincial Surgeon by the headmen of the Province. All necessary action was taken in each case to prevent the spread of infection. There had been no serious epidemic in the Province this year, and no further cases resulted from the solitary cases of cholera and smallpox.

*Buildings and Housing Ordinance.*—The work done under this head is as follows:—

|  |    |    |     |
|--|----|----|-----|
| Number of building applications referred for report ..                 | .. | .. | 242 |
| Number of building applications recommended ..                         | .. | .. | 199 |
| Number of new buildings constructed ..                                 | .. | .. | 65  |
| Number of buildings reconstructed ..                                   | .. | .. | 32  |
| Number condemned as unfit for human habitation ..                      | .. | .. | 30  |
| Number of closing orders obtained ..                                   | .. | .. | 8   |
| Number of buildings demolished as unfit for human habitation ..        | .. | .. | 41  |
| Number of buildings improved by providing windows and cement drains .. | .. | .. | 184 |
| Number of new windows put in ..  | .. | .. | 138 |

Building applications from all the Sanitary Board towns and Local Board towns are referred to the Medical Officer of Health, thus enabling him to scrutinize them and make suggestions where necessary. It has been the practice to issue certificates of conformity before new buildings are occupied. New buildings are made to conform to the Housing Ordinance wherever possible.

As regards the enforcement of the Housing Ordinance in the Central Province, the Medical Officer of Health makes the following remarks :—“One often hears opinions expressed of the impracticability of its application, and there is a tendency to overlook its requirements. Whilst certain amendments may be desirable, the necessity for enforcing the standards laid down by the Ordinance cannot be too strongly emphasized both from its general sanitary importance and its effects in the fight against tuberculosis.”

Owing to the poverty of the owners concerned, and also to the limited housing accommodation available, vigorous action could not be taken in improving or demolishing insanitary dwellings, hence the progress in this direction is slow. There is a great demand for houses in most towns of Kandy and Nuwara Eliya Districts, but little effort is made by the owners of the building sites in these towns to meet it by erecting suitable houses and developing the town. It is only by these means that the existing overcrowded and insanitary conditions could be remedied. The three towns where these conditions prevail to a great extent are Hatton, Talawakele, and Maskeliya.

*Residential Areas.*—Recommendations have been made for regulating and preserving the character of such special areas in each of the various towns in the Province. Matale has already passed by-laws reserving such areas. In the case of the three Local Board towns, recommendations have been referred to Unofficial Members and are under consideration. In the case of Sanitary Board towns, it was thought that they were not sufficiently large as to warrant such regulations.

*Rural Sanitation.*—The Inspectors stationed in various Sanitary Board towns attended to the rural areas around their stations. The work done has been : (1) Installation of latrines ; (2) attention to general cleanliness of premises and abatement of nuisances ; (3) attention to cases of infectious diseases.

As has been pointed out before, the authority to work in rural areas is limited, and no change has been effected during the year.

*Abatement of Nuisances.*—

|  |    |    |       |
|--|----|----|-------|
| Number of notices served ..                    | .. | .. | 1,095 |
| Number of notices voluntarily complied with .. | .. | .. | 779   |

The notices were served for following offences :—

|   |    |    |     |
|---|----|----|-----|
| Insanitary premises ..                      | .. | .. | 832 |
| Ruinous buildings ..                        | .. | .. | 4   |
| Insanitary galas and cattle sheds ..        | .. | .. | 156 |
| Ill-ventilated and ill-lighted dwellings .. | .. | .. | 8   |
| Breach of by-laws re trade premises ..      | .. | .. | 58  |
| Faecal pollution of premises ..             | .. | .. | 42  |

*Prosecution in Board Towns.*—

|                           |    |    |           |
|---------------------------|----|----|-----------|
| Number of prosecutions .. | .. | .. | 827       |
| Number convicted ..       | .. | .. | 549       |
| Number warned ..          | .. | .. | 132       |
| Number discharged ..      | .. | .. | 8         |
| Total amount of fines ..  | .. | .. | Rs. 3,744 |

*Railway Sanitation : Summary of Work done during the Year.*

## Inspections—

## (a) Of Stations.

| In connection with         | Inspected. | Defective. | Improved. |
|----------------------------|------------|------------|-----------|
| Premises ..                | 1,566 ..   | 203 ..     | 148       |
| Drains ..                  | 1,571 ..   | 324 ..     | 270       |
| Latrines ..                | 2,675 ..   | 385 ..     | 259       |
| Mosquito-breeding spots .. | 233 ..     | 98 ..      | 53        |
| Water supply ..            | 1,077 ..   | 143 ..     | 73        |
| Scavenging ..              | 1,078 ..   | 232 ..     | 179       |
| Conservancy ..             | 1,270 ..   | 116 ..     | 90        |

## (b) Of Bungalows.

|                             |          |        |     |
|-----------------------------|----------|--------|-----|
| Premises ..                 | 4,059 .. | 813 .. | 602 |
| Drains ..                   | 3,774 .. | 694 .. | 549 |
| Latrines ..                 | 4,145 .. | 491 .. | 348 |
| Mosquito-breeding places .. | 408 ..   | 197 .. | 178 |
| Water supply ..             | 2,294 .. | 77 ..  | 18  |
| Scavenging ..               | 2,918 .. | 563 .. | 384 |
| Conservancy ..              | 2,761 .. | 167 .. | 121 |

## (c) Of Lines.

|                            |          |        |     |
|----------------------------|----------|--------|-----|
| Premises ..                | 2,814 .. | 823 .. | 634 |
| Drains ..                  | 2,476 .. | 742 .. | 521 |
| Latrines ..                | 1,994 .. | 613 .. | 224 |
| Mosquito-breeding spots .. | 284 ..   | 149 .. | 124 |
| Water supply ..            | 1,260 .. | 203 .. | 18  |
| Scavenging ..              | 1,956 .. | 490 .. | 349 |
| Conservancy ..             | 1,148 .. | 166 .. | 134 |

*Infectious Diseases.*—The following infectious diseases were reported, and all necessary action was taken in regard to them:—Chickenpox 3, measles 14, typhoid fever 5, dysentery 1, tuberculosis 1.

*Analysis of Water.*—Water from 11 sources at different stations were analysed, of which only 2 were found to be satisfactory. Action was taken to improve the unsatisfactory sources, which are all wells. One well was rebuilt, 6 cleaned, and 2 remain to be attended to.

*Summary of Work done by the Railway Sanitary Inspector engaged in Anti-malarial Work.*—

- (1) 89 pits filled up, the capacity of which was 106,633 $\frac{1}{2}$  cubic feet.
- (2) 142 pits were dug to bury refuse and water stagnating receptacles, and they were 14,451 cubic feet in capacity.
- (3) 53 new drains were provided, which were 9,202 $\frac{1}{2}$  cubic feet in capacity.
- (4) 35 existing drains were drained and cleared, and 8,677 $\frac{1}{2}$  cubic feet of earthwork was removed.
- (5) 11,220 square feet of area were drained of stagnant water.
- (6) 18 $\frac{2}{3}$  gallons of kerosine oil, and
- (7) 34 $\frac{3}{4}$  gallons of liquid fuel were used in oiling.
- (8) 4,234,050 $\frac{1}{2}$  square feet of area were cleared up of weeds, jungle, refuse, and water stagnating receptacles.
- (9) 367 palmyra plants were uprooted and buried; 39 palmyra stumps were removed, burnt, or buried; 28 palmyra trunks were cleared.
- (10) 307 overhanging trees were pruned.
- (11) 716 feet of overhanging live fences were pruned.
- (12) 1 well was baled out and cleaned.
- (13) 2,474 days (19,887 working hours) were spent on anti-malarial work.
- (14) 18 station areas were worked by
- (15) 8·24 men per day on an average.

*General Remarks.*—The statements made in my last report regarding the lack of legal status by members of the Sanitary Department and the urgent need for a Public Health Ordinance still hold good.

It is a regrettable fact that many local sanitary authorities continue to appoint untrained men as Sanitary Inspectors when vacancies occur.

One Sanitary Board appointed its own untrained man to a town the sanitation of which had been looked after by officers of this Department for nearly 10 years without expense to the Board. No reasons have been given for this retrograde step, which is bound to affect the health of the town in question, as it is an endemic centre of enteric fever. Matters have been represented to the authorities concerned, but no action has yet been taken.

In conclusion, I wish to point out that this report is a record of the activities of the Sanitary Department only during the year under review, and does not include the work done in Local Board and Urban District Council areas and in Sanitary Board towns outside the Western, Central, and Southern Provinces.

Until the whole Island has been taken up for sanitary work and the Sanitary Department has general oversight of such work, it would not be possible to write a comprehensive report on the public health of the Colony.

## SECTION IV.—METEOROLOGY

29. *Rainfall.*—The area in which the total rainfall of 1924 was above average included practically all the south-west quadrant of the Island and extended along the south coast, and also up the west coast nearly to Puttalam. It also included an appreciable area north of the main hill-country (e.g., Nalanda, Dambulla) and parts of the Eastern Province (notably in the south of that Province). In the central hills there were variations both above and below average with a slight preponderance of the latter.

Practically the whole of the north of the Island and the greater part of the east side had deficient rainfall, comprising in all an area about equal to that in which the rain was above average. As regards individual stations, Carney (Adam's Peak) once again leads with 288·7 inches, Kenilworth being next

with 233·1. At the former station the average is 231·8, so that the offset is 56·9 inches above it. Other stations with offsets of over 50 inches were Anningkanda and Urubokka; while offsets of over 40 inches were recorded at Labugama, Keragala, and Panilkanda. The offset at Colombo was within a few points of 40 inches, and though not quite so great as those mentioned above, caused sufficient inconvenience to attract some attention.

September 29–30 holds the record for the highest fall in 24 hours, a list of 46 stations at which over 5 inches fell on that day being headed by Maliboda and Carney with approximately 12 inches each.

At the other extreme Marichchikaddi still holds the minimum average (34·3), but the lowest totals for the year were recorded rather further north. Elephant Pass Saltern 22·9 leads from the Elephant Pass Public Works Department station 28·2. Other stations under 40 inches were Kilinochchi, Pallai, and (in the south-east area) Panama.

30. *Temperature.*—In 1924 only one station, Nuwara Eliya, had a mean temperature that differed by as much as a degree from its own average, namely, 60·4 or 1·2° F. above its average of 59·2. This station is the highest at which regular observations are made (6,000 feet), and hence is usually the one at which the lowest temperatures are recorded. This year its air temperature on one occasion got below freezing point (31·6° on December 28), and the surface thermometer, which is usually a trifle lower than the air thermometers, got below 32° F. on nine occasions. Its record minimum air temperature is 27·1° F., which was recorded on February 8, 1914. At the other extreme Trincomalee holds the records both for highest average shade temperature (82·9° F.) and highest shade temperature on record (103·7° F. on May 12, 1890). The corresponding figures at that station for 1924 were 82·8 and 97·6, though the highest shade temperature recorded in the Island during the year was 98·9 at Anuradhapura on September 7.

At Colombo the mean temperature of the year was 81° or 0·2 above its average of 80·8°. The extreme readings were 93·5 and 66·7, both recorded during March.

The mean daily range for the year, *i.e.*, the difference between the mean of the maximum and the mean of the minimum, was highest at Badulla (17·6° F.) and lowest at Galle (7·8° F.). At Colombo and Kandy it was 11·9° F. and 16° F. respectively. The absolute range for the year, *i.e.*, the difference between the highest and the lowest readings actually recorded at any one station, was greatest at Nuwara Eliya (47·5° F.) and lowest at Galle (19·3° F.).

*General Remarks.*—There is a marked variation in climate between the different parts of Ceylon. In the low-country, with a mean temperature of the order of 80° F., a noticeable feature is the small range of both temperature and pressure. There is, however, wide divergence between the moist conditions in the south-west of the Island, where the average annual rainfall varies from 100 to over 200 inches, and the dry zone areas of the north, north-west, and south-east.

Altitudes up to 8,000 feet occur inland, and there the temperature is cooler, and shows a bigger range. There is a corresponding change in vegetation, and the conditions are altogether more akin to those in the temperate zone.

#### SECTION V.—HOSPITALS, ASYLUMS, AND DISPENSARIES.

31. In 1924 there were 83 Government general hospitals, providing about 7,677 beds with varying accommodation from 16 beds in smaller outstations to 800 beds in the General Hospital, Colombo. There were in addition a number of special hospitals, *viz.*, a lying-in home with 100 beds, an eye hospital with 60 beds, a women's hospital of 34 beds, a children's hospital of 50 beds, a female venereal hospital of 30 beds, a police hospital of 34 beds, a tuberculosis hospital for chronic cases of 326 beds, a tuberculosis sanatorium of 72 beds, an infectious diseases hospital of 100 beds, a lunatic asylum with 1,200 beds, a leper asylum near Colombo with 450 beds, a temporary lunatic asylum with 150 beds at Matara in the Southern Province, and a leper asylum with 150 beds in the island of Mantivu in the Eastern Province.

Seventy-eight estate hospitals and 593 estate dispensaries were maintained by proprietors of estates.

There were 533 Government dispensaries in different parts of the Island in 1924, and 2,497,122 patients who paid 3,573,694 visits were treated at these dispensaries and the out-patient departments of hospitals during the year, as against 2,742,868 and 3,961,183 respectively in 1923. The total number of in-patients who were treated at the various hospitals was 176,787 with a mortality rate of 12,071, as against 188,113 and 6·87 respectively the previous year.

The following buildings were completed during the year:—Two wards of 20 beds each and extension of Nurses' Quarters, Ragama Tuberculosis Hospital; Paying Ward, Matale Hospital; Temporary Children's Ward, Kandy Hospital; Additional room, latrines, &c., to Hospital Attendants' Quarters, and minor additions, Nuwara Eliya Hospital; additions to Apothecary's Quarters, Uda Pussellawa Hospital; extension to Nurses' Quarters and to Apothecary's Quarters, Pussellawa Hospital; Maternity Ward, Dimbula Hospital; Quarters for Second Apothecary, Dikoya Hospital; Senior Medical Officer's Quarters, Galle; new Mosquito-proofed Ward, Maternity Ward, and District Medical Assistant's Quarters, Deniyaya Hospital; Temporary Ward, Kilinochchi Hospital; Quarters for District Medical Assistant and Second Apothecary, Kahawatta Hospital; ward of 6 beds for Embilipitiya Dispensary; and additions to Nurses' Quarters, Ratnapura Hospital.

32. The following is a summary of the chief features of the report of the Medical Superintendent, General Hospital, Colombo:—

767 patients remained in hospital on December 31, 1923; 47 in the paying section and 720 in the non-paying section. During the year 17,171 patients were admitted, 16,024 to the non-paying wards and 1,147 to the paying wards. At the Out-patient Department 33,710 persons were treated, representing 76,688 attendances, *i.e.*, a daily average attendance of over 200. Of the 1,194 under treatment in the paying section, 1,060 were discharged, 82 died, and 52 remained on December 31, 1924. Of the 16,744 under treatment in the non-paying section, 14,308 were discharged, 1,746 died, and 690 remained on December 31, 1924.

The daily average sick in hospital was 65·33 in the paying section, and 703·05 in the non-paying section.

The maximum and minimum numbers of patients in hospital on any one day during the year 1924 in the paying and non-paying sections respectively was as under :—

| Paying Section. |    |    |    |                       |  |
|-----------------|----|----|----|-----------------------|--|
| Maximum         | .. | .. | .. | 87 on August 14, 1924 |  |
| Minimum         | .. | .. | .. | 48 on January 1, 1924 |  |

| Non-paying Section. |    |    |    |                        |  |
|---------------------|----|----|----|------------------------|--|
| Maximum             | .. | .. | .. | 820 on August 15, 1924 |  |
| Minimum             | .. | .. | .. | 590 on March 3, 1924   |  |

Of the 16,024 admitted in 1924 to the non-paying section, 6,586 were surgical cases and 9,438 were medical cases.

The number of surgical operations performed in 1924 was 2,824, exclusive of 128 minor operations performed in the Out-patient Department.

2,394 operations were performed in non-paying section with 116 deaths, giving a percentage mortality of 4.0.

In the paying section the number of operations was 430 with 27 deaths, giving a percentage mortality of 6.2.

The following table gives the figures for the past three years of the cases under treatment, the percentage mortality, and the daily average number in hospital in the paying and non-paying sections, respectively :—

| Paying Section. |                        |         |                       |                     |  |
|-----------------|------------------------|---------|-----------------------|---------------------|--|
| Year.           | Cases under Treatment. | Deaths. | Percentage Mortality. | Daily Average Sick. |  |
| 1922            | .. 997                 | .. 59   | 5.9                   | .. 49.6             |  |
| 1923            | .. 1,050               | .. 74   | 7.4                   | .. 55.05            |  |
| 1924            | .. 1,194               | .. 82   | 6.8                   | .. 65.38            |  |

| Non-paying Section. |           |          |       |           |  |
|---------------------|-----------|----------|-------|-----------|--|
| 1922                | .. 16,331 | .. 1,847 | 11.30 | .. 764    |  |
| 1923                | .. 16,562 | .. 2,000 | 12.07 | .. 713.55 |  |
| 1924                | .. 16,744 | .. 1,746 | 10.42 | .. 703.05 |  |

As regards particular diseases the following figures are appended showing their prevalence and mortality during the last three years :—

| Anchyllostomiasis. |                           |  | Malaria.   |                            |  |
|--------------------|---------------------------|--|------------|----------------------------|--|
| Year.              | Cases and Deaths.         |  | Year.      | Cases and Deaths.          |  |
| 1922 ..            | 585 cases with 81 deaths  |  | 1922 ..    | 2,121 cases with 37 deaths |  |
| 1923 ..            | 553 cases with 134 deaths |  | 1923 ..    | 2,250 cases with 15 deaths |  |
| 1924 ..            | 524 cases with 72 deaths  |  | 1924 ..    | 2,610 cases with 14 deaths |  |
| Appendicitis.      |                           |  | Parangi.   |                            |  |
| 1922 ..            | 167 cases with 5 deaths   |  | 1922 ..    | 306 cases with 4 deaths    |  |
| 1923 ..            | 169 cases with — deaths   |  | 1923 ..    | 426 cases with — deaths    |  |
| 1924 ..            | 171 cases with 2 deaths   |  | 1924 ..    | 430 cases with — deaths    |  |
| Dysentery.         |                           |  | Pneumonia. |                            |  |
| 1922 ..            | 262 cases with 69 deaths  |  | 1922 ..    | 685 cases with 364 deaths  |  |
| 1923 ..            | 194 cases with 88 deaths  |  | 1923 ..    | 381 cases with 189 deaths  |  |
| 1924 ..            | 185 cases with 87 deaths  |  | 1924 ..    | 539 cases with 256 deaths  |  |
| Enteric Fever.     |                           |  | Phthisis.  |                            |  |
| 1922 ..            | 297 cases with 95 deaths  |  | 1922 ..    | 527 cases with 232 deaths  |  |
| 1923 ..            | 248 cases with 104 deaths |  | 1923 ..    | 517 cases with 257 deaths  |  |
| 1924 ..            | 260 cases with 102 deaths |  | 1924 ..    | 535 cases with 226 deaths  |  |

Malaria seems to be steadily on the increase, but I think that this can be partly accounted for by the fact that with the facilities of travel a very large number of persons from outlying districts and even from distant parts seek treatment at this institution.

Pneumonia shows a large increase over last year—539 cases, as compared with 381—and a mortality of 256—very nearly 50 per cent.—many of the cases come in in the last stages of the disease, when little or nothing can be done for them.

As regards other diseases, Dr. Spittel reports that he treated 42 cases of tetanus with 22 deaths—a mortality of over 50 per cent.

*X-Ray Department.*—107 private and 655 hospital cases attended this department. The fees accruing to Government from private patients amounted to Rs. 2,086.

It was decided during the year to charge a fee of Rs. 20 to all first class paying patients requiring X-Ray. The amount received since its introduction was Rs. 360.

*Female Paying Ward.*—This new ward, which is an extension of the present Skinner's Ward, is nearing completion and will soon be ready for opening. It will supply a longfelt want, and the thanks of the public are due to Mr. Gnanasekeram, J.P., U.P.M., the generous donor, after whom the ward will be named.

*Out-patient Department.*—This Department has worked well during the year. Three House Officers are exclusively employed, and their duties are so arranged that prompt medical aid can be obtained at any time day and night. The Rev. Mother Superintendent has kindly increased the staff of Sisters from two to three for duty during the busy hours between 8 and 11 A.M.

*Expenditure and Receipts.*—The receipts during the last financial year from patients in the paying section amounted to Rs. 148,637.69 and in the non-paying section Rs. 7,039.50. The approximate expenditure during the same period was Rs. 51,619.45 in the paying section and Rs. 174,814.45 in the non-paying section; the expenditure in both sections does not include the salaries of the medical and nursing staff nor the cost of drugs and dressings.

The number of cases treated at the Venereal Diseases Clinic during the year was as follows:—524 cases of syphilis, 48 of softsores, 463 of gonorrhœa, 27 of yaws, as against 480 cases of syphilis, 126 of softsores, 336 of gonorrhœa, and 61 cases of yaws in 1923.

The number of cases of yaws has decreased, due probably to the fact that the patients are being energetically treated in their own villages by the Itinerating Medical Officers, and only a few now seek treatment in Colombo.

Only a few patients attend the clinic for two years to take the complete course of treatment, the majority cease attending when their more urgent symptoms have been cured by a few injection of N A B or Hg. 1. Patients are however urged to attend regularly for two years, and leaflets explaining the advisability of completing a full course of treatment are distributed.

All minor operations, such as dilatations of urethral strictures, opening of buboes, circumcisions, removal of venereal warts, are usually done in this clinic either under local or general anaesthesia.

A few are admitted as in-patients when they happen to come from a distance or are too poor to attend to clean dressings in their homes.

33. *The Lunatic Asylum.*—There were 721 males and 483 females in the asylum at the beginning of the year, 318 males and 144 females were admitted during the year, and the total number treated in 1924 was 1,039 males and 627 females, as against 944 males and 612 females treated in 1923 and 868 males and 575 females in 1922.

196 males and 102 females were discharged, and 38 males and 42 females died during the year. The percentage of deaths to total treated was 4·80 in 1924, 8·16 in 1923, and 6·23 in 1922. The principal causes of death were dysentery 21, tuberculosis 18, general debility and senile decay 10, and diarrhoea and enteritis 9, as against 23, 51, 12, and 13 respectively the previous year.

The daily average number resident for asylum cases was 757·37 males and 479·60 females, as compared with 668·1 males and 475·03 females in 1923 and 602·58 males and 443·42 females in 1922.

In the House of Observation 19 males and 9 females remained at the end of the previous year, 243 males and 99 females were admitted, and a total number of 262 males and 108 females had to be dealt with during the year, as against 362 males and 148 females in 1923. Of the cases dealt with, 161 males and 70 females were transferred to the asylum. Eighty-two males and 30 females were discharged, and 5 males and 3 females died. The deaths in 1923 were 18 males and 8 females.

The numbers remaining on December 31, 1924, were 27 males and 7 females. The daily average for both institutions together was 781·93 males and 489·84 females, as against 714·89 and 498·1 respectively the previous year. The largest number resident on any one day during the year was 1,291 and the lowest 1,198, as compared with 1,255 and 1,096 in 1923.

An average of 67 males were employed in gardening, 32 in trade, and 176 in household work. Of the women, 49 were employed in gardening and outdoor work, 44 in sewing, rope making, and mat making, and 100 in household work.

The new asylum at Angoda is nearing completion, and it is hoped to move the patients to Angoda in October next.

34. *The De Soysa Lying-in Home.*—The number of cases under treatment during the year was 3,045, as against 2,934 the previous year, 3,002 in 1922, 3,506 in 1921, and 2,556 in 1920. The death rates for these years were 3·18, 2·4, 2·5, 2·29, and 3·01 per cent. respectively.

Of the 97 deaths during the year, 27 were due to the accidents of childbirth, 7 to puerperal causes, and 63 to intercurrent diseases such as ancylostomiasis, pneumonia, syphilis, enteric fever, nephritis, dysentery, &c.

The number of births was 2,315. Of these, 1,973 infants left the hospital alive, 238 were stillborn, and 104 died after delivery, as against 2,312, 1,874, 299, and 139 respectively in 1923—49 pairs of twins and 3 sets of triplets were born in 1924, 28 pairs of twins and 1 set of triplets in 1923. 211 operations were performed during the year, including the use of forceps in 63 cases, craniotomy in 41 cases, embryotomy in 2 cases, and decapitation in 1 case. Labour was classified as normal in 1,906 cases (occipito anterior 1,702, occipito posterior 204). There were 9 face, 3 brow, 81 pelvic, and 11 transverse presentations. In 19 cases of placenta previa 5 infants were born alive, 12 were born dead, and 2 were undelivered. Fourteen mothers recovered, 5 died. Of 47 cases of puerperal eclampsia and 11 cases of contracted pelvis treated during the year, 37 of the former and 7 of the latter recovered and were discharged.

35. *The Victoria Memorial Eye Hospital and the Grenier Ear, Nose, and Throat Infirmary.*—21,679 patients paid 56,360 visits to the Out-patient Department during the year, as against 19,253 and 53,067 respectively in 1923 and 18,931 and 50,262 respectively in 1922. Of the out-patients treated 17,625 were eye cases, 4,054 ear, nose, and throat cases.

The number of new admissions as in-patients was 1,401, as against 1,313 in 1923 and 1,460 in 1922; and the daily average sick in hospital was 90·46 in 1924, 75·24 in 1923, and 78·77 in 1922. The total number of operations performed on in-patients during the year was 522, on out-patients 1,465, the corresponding figures for the previous year being 603 and 1,457 respectively.

There has been a progressive yearly increase in the numbers seeking treatment at this institution and an additional house surgeon, an increase to the nursing staff, and more accommodation for male and female patients will soon have to be provided.

36. *The Lady Havelock Hospital for Women and the Lady Ridgeway Hospital for Children.*—The total number of admissions in 1924 was 2,280, and with those remaining from the previous year the total treated during the year was 2,355, as against 2,481 and 2,569 respectively in 1923. The daily average sick was 87·01 in 1924, 93·53 in 1923.

The number of paying patients admitted during the year was 75, and of these 12 were maternity cases. The percentage of deaths to total treated was 18·4, as against 21·6 the previous year; a great number of these deaths were amongst babies brought to hospital in a moribund condition.

Seventy-two cases of enteric fever, 150 cases of advanced ancylostomiasis, 62 babies suffering from congenital syphilis, 2 cases of diphtheria and serious cases of parangi were admitted during the year. All patients were treated for ancylostomiasis in the non-paying section with oil of chenapodium and carbon tetrachloride, as a routine. A very large number of cases were admitted a few days after confinement suffering from sepsis, retained products, lacerations of cervix and perineum, and vesico-vaginal fistulæ, showing that the midwifery practised by midwives is very bad and not according to modern methods. Several of these cases died shortly after admission.

The number of surgical operations performed was 734—of these, 506 were major and 228 minor—the former included 52 abdominal sections. The operation mortality rate was 4·3 per cent., as against 5·9 per cent. the previous year.

Thirty-four pupils were admitted to the training school during the year. Of these, 6 resigned, 5 were unsuitable, and 1 died of enteric fever, 1 second-year pupil was condemned by a Medical Board, and 1 pupil nurse's services were discontinued in her second year.

Four examinations were held during the year—11 nurses passed and 2 failed.

The total nursing staff consists of 1 European matron, 2 European sisters, 9 Ceylonese charge nurses, and 26 pupils.

37. *The Police Hospital, Borella.*—The number of patients treated during the year was 1,048, as against 1,211 in 1923; 4,842 patients were treated at the Out-patient Department of this hospital and at the nine branch police dispensaries in the town, as against 3,880 in 1923. Of the hospital cases, 200 suffered from malaria, chiefly relapses in police who had been transferred to Colombo from various malarious stations, 227 from influenza, 59 from dysentery, and 102 from venereal diseases. There was only 1 death in 1924 from plague, and the percentage of deaths to total treated was .09, as against 4 deaths and a mortality rate of .33 per cent. the previous year.

A Police Surgeon and an Assistant Police Surgeon are attached to the Police Force in Colombo and its suburbs, and they have the medical care of about 1,500 police of all ranks and their families.

38. *The Infectious Diseases Hospital, Colombo.*—Three permanent wards and several large temporary cadjan sheds in extensive grounds are available at this institution for cases of infectious diseases from Colombo and its neighbouring villages and from infected ships arriving at the port.

The total number of cases treated during the year was 959 with 110 deaths and a mortality rate of 11.47 per cent., as against 1,297 cases treated with 98 deaths and a mortality rate of 7.55 per cent. in 1923, and 804 cases treated, 58 deaths, and a death rate of 7.21 per cent. in 1922.

The number of cases of smallpox admitted during the year was 12—8 were local and 4 were imported cases. Of the local cases, 3 were confluent, 3 modified, and 2 discrete; and of the imported cases, 1 was confluent, 2 were modified, and 1 was discrete. There were no visible marks of vaccination in 3 local cases, and these died of confluent smallpox. All the imported cases had vaccination marks and recovered. The percentage of deaths to total treated was 25 per cent.

Twenty-four primary and 654 revaccinations were performed at the hospital during the year and 287 of these were successful; 367 revaccinations failed.

Seven cases of plague remained in the hospital at the end of the previous year; 71 cases were admitted and a total number of 78 cases were treated during the year with 63 deaths, as against 102 cases with 79 deaths the previous year. Of the cases admitted, 59 were males and 12 were females; 62 were bubonic, 7 septicæmic, and 2 pneumonic. The septicæmic and pneumonic cases proved fatal. Of the deaths from bubonic plague, 38 had groin buboes, 12 axillary, and 4 cervical. Of the recovered cases, 12 had groin buboes and 3 had axillary buboes.

Genuine cases of pneumonic plague occurred for the first time in the town during the year. Of the other infectious diseases admitted during the year, 1 was an imported case of cholera, 8 were cases of diphtheria, 398 of chickenpox, 164 of measles, 59 of mumps, 14 of whooping cough, and 113 cases of enteric fever from rural areas outside the Municipality of Colombo. There is a separate Municipal Enteric Hospital for urban cases.

39. *The Convict Hospitals.*—In 1924 there were 10 hospitals for prisoners: at Borella (Colombo) 213 beds, Welikada (Colombo) 8 beds, Mahara 49 beds, Negombo 17 beds, Bogambra (Kandy) 32 beds, Jaffna 12 beds, Galle 12 beds, Batticaloa 5 beds, Anuradhapura 52 beds, and Badulla 7 beds.

A total number of 7,308 sick prisoners were treated at these hospitals during the year with 82 deaths and a mortality rate of 1.12 per cent., as against 9,724, 83, and .85 per cent. respectively in 1923.

28,337 prisoners paid 43,220 visits to the jail dispensaries to be treated for minor ailments, as against 11,367 and 18,864 the previous year.

Eleven prisons were maintained during the year—at Welikada, Hulftsdorp, Mahara, Negombo, Kandy, Bogambra, Jaffna, Galle, Batticaloa, Anuradhapura, and Badulla, and the number of prisoners in these prisons on December 31, 1923, was 3,216 (3,143 males and 73 females).

14,215 male prisoners and 485 female prisoners were admitted, 14,078 males and 483 females were discharged, and 93 males and 1 female died during the year, as against 15,120, 451, 15,022, 426, 83, and 0 respectively in 1923. The death-rate for 1924 was .5 per cent., as against .4 for 1923.

The general health of the prisoners was satisfactory during the year.

At the *Borella Convict Hospital* 2,820 cases were treated during the year with 68 deaths and a mortality rate of 1.81 per cent., as against 3,281 cases, 47 deaths, and a death rate of 1.43 per cent. in 1923. The daily average sick for the year was 85.25, as against 93.58 the previous year. Of the cases treated during the year, 336 were cases of influenza, 33 of pulmonary tuberculosis, 353 of dysentery, 309 of conjunctivitis, and 135 of malaria.

At the *Mahara Jail Hospital* 2,740 cases were treated during the year with 6 deaths and a percentage of deaths to total treated of .21, as against 4,002, 9, and .22 per cent. in 1923.

The daily strength of the jail was 740.10, daily average 75.06, the percentage of deaths to strength of jail 1.23, as against 671.78, 68.57, and 1.35 the previous year.

The percentage of sick to strength of jail was 9.86 in 1924 and 10.2 in 1923.

Malaria is endemic at Mahara, but there has been a marked diminution in the incidence of this disease during the year. Active preventive measures, which commenced in the latter half of 1922 and were continued in 1923 being continued in 1924 also. The number of cases of malaria treated in hospital during the year was 712 with 1 death, as against 2,033 cases with 2 deaths in 1923 and 3,377 cases with 20 deaths in 1922. Of the 712 cases of malaria admitted to the hospital, 156 were primary infections and 556 subsequent attacks. The corresponding figures for the previous year were 2,033, 326, and 1,707, respectively. 803 prisoners were examined for enlarged spleens during the year, and of these 119 were found to have spleens palpable below the costal margin—a spleen index of 14.81 per cent. only.

40. *Medical Institutions aided by Government.*—The following institutions were aided by Government during the year:—

(1) The Victoria Home for Incurables; (2) Wiseman Hospital, Welimada; (3) McLeod Hospital, Inuvil; (4) Jevon's Dispensary, Puttur; (5) Jevon's Dispensary, Batticaloa; (6) the Wesleyan Medical Mission Dispensary at Kattankudy; and (7) The Denepitiya Medical Mission Hospital in Southern Province: Nos. (1) and (7) for males and females, Nos. (2) to (6) for women and children only.

*Victoria Home for Incurables*.—Eighty-nine patients remained on December 31, 1923, and 34 were admitted during the year. Of these 21 died, 13 were discharged, and 89 remained at the end of the year; as against 46, 20, 10, and 89, respectively, reported the previous year.

*Wiseman Hospital, Welimada*.—344 patients were treated in hospital during the year, including 30 maternity cases; of these 13 died, 327 were discharged, and 4 remained at the end of the year. The number of cases treated at the dispensary was 2,946, as against 2,889 in 1923. The diseases treated were mostly dysentery, ancylostomiasis, pneumonia, scabies, burns and scalds, ulcers, and malarial fever.

*McLeod Hospital, Inuvil*.—The total number of in-patients treated during the year was 2,289 with 126 deaths and a mortality rate of 5·05 per cent., as against 1921, 74 and 3·85 per cent., respectively, in 1923, and 1,868, 96, and 5·13 per cent., respectively, in 1922.

The number of maternity cases treated in 1924 was 658—583 in hospital and 75 in the villages—and in 1923, 571, 505, and 66, respectively. Of the 658 maternity cases 436 were normal, and 96 premature labours, 29 pairs of twins, and 1 set of triplets were born during the year. There were 97 stillbirths, 53 of which were premature. The causes of the majority of the premature labours were ancylostomiasis, malaria, nephritis, and dysentery. Of 37 cases of eclampsia 25 recovered. Pupil midwives are being trained here for service in the villages, 4,031 out-patients paid 7,212 visits in 1924, as against 3,871 and 5,356, respectively, the previous year.

*The Jevon's Dispensary, Puttur, Northern Province*.—Much educational work in regard to maternal and infant welfare and home nursing and prophylactic work were done during the year in Puttur and the surrounding villages by the Sisters of the Wesley Deaconess Order. 504 patients were seen 1,362 times at the dispensary and in the villages, as against 687 and 1,832, respectively, in 1923. Many patients were persuaded to go as in-patients to the Inuvil Hospital.

*The Jevon's Dispensary, Batticaloa*.—2,037 visits were paid by out-patients in 1924, as against 1,597 in 1923. Several maternity cases were treated in the town. In the small ward of 3 beds attached to this dispensary 43 patients were treated during the year with 1 death. The Lady-in-Charge visits the homes of the poor, gives advice to expectant mothers, and attends on maternity cases.

*The Wesleyan Mission Dispensary at Kattankudy* is visited by the Medical Missionary Lady-in-Charge of the Jevon's Dispensary, Batticaloa, and large numbers of Muslim women and children attend for advice and treatment. Her services are also available in cases of accouchement in this thickly populated Muslim village.

*The Deneppitiya Medical Mission Hospital* was established during the year by the members of the Anglo-Catholic Union, and is in charge of a qualified Medical Officer. Cases of parangi were treated here with drugs supplied by Government.

#### SECTION VI.—MISCELLANEOUS.

**41. Report on the Working of the King Edward VII. (Memorial) Anti-Tuberculosis Fund during the Year 1924.**—The Sub-Committee of the King Edward VII. (Memorial) Anti-Tuberculosis Fund has placed on record its opinion that the alleviation of the disease of tuberculosis in this Colony depends chiefly upon increased attention being paid on the part of Government, and local authorities, and of the general public to sanitary reform in all congested areas.

A circular letter was accordingly issued to all Municipalities, Urban District Councils, Sanitary and Local Boards in the Island, inquiring what steps were being taken in their respective areas towards sanitary reform, and from the replies received to the circular letter, it is satisfactory to note that everything possible, as far as funds permit, is being done towards the improvement of insanitary areas.

With a view to educating the public in the value of fresh air, cleanliness, hygienic living, &c., a series of seven health letters dealing with the incidence, spread, and prevention of tuberculosis was published in the English and vernacular newspapers in Colombo and Jaffna, and the Sub-Committee's thanks are due to the Press for the prominence given to them. These letters will be repeated every year. A number of posters in English, Sinhalese, and Tamil regarding the prevention and cure of tuberculosis were also distributed throughout the Island, and these posters too will be issued at intervals of at least once a year.

#### ADDITIONS AND IMPROVEMENTS.

During the past year the following additions and improvements to the three anti-tuberculosis institutions at Colombo, Kandana, and Ragama were executed out of the funds at the disposal of the Sub-Committee:—

*Anti-Tuberculosis Institute, Colombo*.—Glazed tiles have been fixed on the outside verandahs of this institute at a cost of Rs. 2,645·87.

*Kandana Sanatorium*.—(a) The sanatorium premises have been fenced at a cost of Rs. 2,127·75.

(b) A dhoby house, working tanks, and quarters for dhobies have been provided at a cost of Rs. 6,560·11.

*Ragama Hospital*.—(a) Dhoby accommodation has been provided at a cost of Rs. 2,443·38.

(b) Two additional wards to accommodate 40 beds have been constructed at a cost of Rs. 29,498·91.

(c) Two bedrooms, with bath and earth closet attached, have been added to the nurses' quarters at a cost of Rs. 5,500.

(d) Two tennis courts for Kandana sanatorium and Ragama hospital have also been provided at a cost of Rs. 235.

#### WORKS IN PROGRESS.

*Kandana Sanatorium*.—A combined scheme for the supply of water and electric light to the Kandana sanatorium is at present being carried out by the Public Works Department at an estimated cost of Rs. 25,035.

It may be mentioned in this connection that Mr. A. E. de Silva has very generously donated a further strip of land at Kandana, on which an engine house and a well in connection with this scheme are to be erected. The thanks of the Sub-Committee are in no small measure due to Mr. de Silva for his generosity in continuation of that of his father.

*Ragama Hospital.*—Dhobies' lines of 3 rooms, a 60-gallon Farmer's boiler in the steaming room, and a drying stove in the drying room are being provided at an estimated cost of Rs. 4,000.

*New Sanatorium in the Northern Province.*—The Sub-Committee has decided to erect a new sanatorium in the Northern Province at a cost not to exceed Rs. 100,000. A site near Kankesanturai was selected for the sanatorium, but it has been found to be unsatisfactory. A new site has since been selected, and is under consideration. It is hoped that the whole or a portion of the land, which will otherwise have to be acquired, will be donated for the sanatorium.

H. K. HILLYER,  
Honorary Secretary.

### KING EDWARD VII. ANTI-TUBERCULOSIS FUND.

#### Summary Statement of Receipts and Payments for the Year ending December 31, 1924.

| RECEIPTS.  | Rs.     | c. | PAYMENTS.   | Rs.    | c.  | Rs.      | c.         |
|--|---------|----|---|--------|-----|----------|------------|
| To balance on December 31, 1923 ..   | 176,967 | 35 | By Director of Public Works<br>being amounts deposited<br>to cover cost of works as<br>follows :— |        |     |          |            |
| Refunds of unexpended balances on<br>works per Director of Public Works .. | 2,377   | 40 | Additional bedrooms,<br>Ragama ..   | 5,500  | 0   |          |            |
| Interest on current bank account ..  | 456     | 81 | Fixing glazed tiles to the<br>institute at Colombo ..   | 2,650  | 0   |          |            |
| Interest on fixed deposit account ..                                       | 6,452   | 13 | Half cost of two addi-<br>tional wards at Ragama<br>hospital ..                                   | 15,500 | 0   |          |            |
|  |         |    | Provision of water and<br>electricity at Kandana  | 10,000 | 0   |          |            |
|  |         |    | Dhoby accommodation<br>and fencing of wards<br>at Kandana hospital ..                             | 3,500  | 0   |          |            |
|  |         |    | Two additional wards and<br>other works at Ragama<br>hospital ..                                  | 15,000 | 0   |          |            |
|  |         |    | Dhoby accommodation<br>at Ragama ..   | 4,000  | 0   |          |            |
|  |         |    |   |        |     | 56,150   | 0          |
|  |         |    | By advertising, posters, &c. ..   | —      | 70  | 0        |            |
|  |         |    | Fees for audit and other<br>clerical work ..  | —      | 107 | 90       |            |
|  |         |    | Sundries (postage stamps,<br>&c.) ..  | —      | 0   | 12       |            |
|  |         |    | By balance on December<br>31, 1924—   |        |     |          |            |
|  |         |    | On current account ..   | 30,723 | 17  |          |            |
|  |         |    | On fixed deposit with<br>Imperial Bank ..   | 69,202 | 50  |          |            |
|  |         |    | On fixed deposit with<br>Eastern Bank ..  | 30,000 | 0   | 129,925  | 67         |
|  |         |    |   |        |     | Total .. | 186,253 69 |
| Total ..   | 186,253 | 69 |   |        |     |          |            |

Audited and found correct :

F. G. MORLEY,  
Colonial Auditor.

H. N. COLLYER,  
Honorary Treasurer.

January 27, 1925.

42. *The Ceylon Medical College Staff.*—Dr. F. O'B. Ellison, M.D., B.Ch., B.A.O., B.A. (Dublin University T.C.D.), who had been appointed by the Secretary of State to be Registrar of the Medical College and Professor of Physiology, on September 28, 1923, assumed duties on October 22, 1923, and took over the administration of Medical College.

Dr. Andreas Nell on retiring from the post of Surgeon in Charge, Victoria Memorial Eye Hospital, ceased to be Lecturer in Ophthalmology and his place was taken by his successor Dr. H. P. Joseph, L.M.S. (Ceylon), M.R.C.S. (Eng.), L.R.C.P. (Lond.).

Additional appointments to the teaching staff were : Lecturer on Diseases of the Skin, Dr. R. L. Spittel, F.R.C.S. (Eng.) ; Lecturer (Clinical) on Diseases of Children, Miss C. E. Anderson, M.B. Ch.B. (Aberdeen), F.R.C.S. (Edin.) ; Lecturer on Medical Electricity and X-Rays, Dr. F. O'B. Ellison, M.D., B.Ch., B.A.O., B.A. (T.C.D.) ; Dr. S. Somasunderam, Demonstrator in Physiology, Assistant in Practical Pathology, and Lecturer in Elementary Anatomy and Physiology, *vice* Drs. V. Gabriel and S. Chelliah ; Dr. W. A. Karunaratne, Lecturer in Pathology ; Dr. S. C. de S. Wijeyratne, Lecturer on Clinical Medicine, Out-patient Department, since succeeded by Dr. F. Gunaratne.

*Students.*—According to the rules laid down by the General Medical Council of the United Kingdom, entrance is now through the medium of the Pre-Medical Examination in Chemistry, Physics, and Biology. This examination was held for the first time in June, 1924 ; 26 candidates presented themselves, of whom 10 were successful, and duly entered the Medical School in October, 1924.

The standard of answering reached by the candidates was very poor.

Under the new arrangement students on entry will have completed their Chemistry, Physics, and Biology course with the exception of Biochemistry, and the First Professional Examination will be taken at the end of the second year in Anatomy and Physiology. The following table shows the number of students enrolled for each Session :—

|                     |    |    | 1923-1924.     | 1924.     |
|---------------------|----|----|----------------|-----------|
|                     |    |    | October-March. | May-July. |
| First Year          | .. | .. | ..             | —         |
| Second Year         | .. | .. | 32             | .. 31     |
| Third Year          | .. | .. | 53             | .. 36     |
| Fourth Year         | .. | .. | 46             | .. 46     |
| Fifth Year          | .. | .. | 54             | .. 60     |
| First Apothecaries  | .. | .. | 7              | .. 12     |
| Second Apothecaries | .. | .. | 19             | .. 19     |
|                     |    |    | 211            | 204       |

The following table gives the results of the examinations held during the year :—

| Examination.           | December, 1923. |         |       | March, 1924. |       |         | July, 1924. |         |      |
|------------------------|-----------------|---------|-------|--------------|-------|---------|-------------|---------|------|
|                        | Sat.            | Passed. | Sat.  | Passed.      | Sat.  | Passed. | Sat.        | Passed. | Sat. |
| Final                  | .. 19           | .. 6    | .. 26 | .. 6         | .. 23 | .. 8    |             |         |      |
| Third Professional     | .. —            | .. —    | .. 27 | .. 22        | .. 26 | .. 11   |             |         |      |
| Second Professional    | .. —            | .. —    | .. 36 | .. 22        | .. 26 | .. 12   |             |         |      |
| First Professional     | .. —            | .. —    | .. 17 | .. 8         | .. 7  | .. 1    |             |         |      |
| Pre-Medical            | .. —            | .. —    | .. —  | .. —         | .. 21 | .. 10   |             |         |      |
| First Apothecaries'    | .. —            | .. —    | .. 5  | .. 4         | .. 2  | .. 1    |             |         |      |
| Second Apothecaries'   | .. —            | .. —    | .. 7  | .. 5         | .. 16 | .. 14   |             |         |      |
| Apothecaries' Entrance | .. —            | .. —    | .. —  | .. —         | .. 48 | .. 3    |             |         |      |

Permission was obtained from the Government to hold a Final Examination in December each year regularly, instead of as a special arrangement.

The following Scholarships, Médals, and Prizes were awarded during the year :—

Mr. M. L. Corera, Second Professional Scholarship from October, 1923.

The Entrance Scholarship awarded to Mr. S. A. Vettivelu in 1922 was cancelled in 1924 under rule 4 for not passing the First Professional Examination within the regulation time.

Loos Gold Medal for Pathology to Mr. W. James Silva.

Mathew Medal for Medical Jurisprudence to Mr. W. James Silva.

Vanderstraaten Silver Medal for Hygiene to Mr. R. Caldera.

185 Medical and 26 Apothecary Students entered for the classes at the beginning of the year, and 20 Medical and 9 Apothecary Students qualified during the year.

The expenditure of the College amounted to Rs. 66,504 and the fees received to Rs. 30,024.50 during the year.

A special grant of Rs. 5,000 was asked for and received from the Treasury to provide necessary equipment for the Physiological department. This has been ordered, but at the time of writing this report had not yet been received.

The work of the College continues to be seriously handicapped by the lack of class and lecture-room accommodation in the department of Physiology and Pathology, and the lack of space for Clinical demonstrations and side room work in Medicine.

*Medical Registration.*—Thirty-five names were added to the Medical Register during 1924, and 1 was added to the Dental Register, also 1 dentist received the licence to practise under section 20 of Ordinance No. 3 of 1915.

The only names removed from the Register during the year were those of deceased medical practitioners.

43. *Civil Medical Stores.*—During the year no difficulty was experienced in obtaining supplies of drugs, &c., and these were sufficient. Demands for drugs from hospitals and dispensaries greatly increased during the year, and in several instances nearly double the previous year's supplies had to be issued.

Drugs and instruments were purchased at a cost of Rs. 991,525, of which a sum of Rs. 367,634 was expended on quinine bisulph and tablets. 143,500 oz. of quinine and 635,000 tablets costing Rs. 230,090 were issued during the year.

Opium preparations costing Rs. 6,390 were procured; no crude opium was purchased as sufficient stock was in hand. The sale of opium preparations realized Rs. 4,126.

Cannabis indica extract was purchased for Rs. 296, and the receipts from the sale of this preparation amounted to only Rs. 12.

Free drugs to the value of Rs. 11,081 were issued to Government Departments other than the Medical Department, and 43,289 bulbs of salvarsan, &c., for the treatment of parangi, costing Rs. 108,796 were issued during the year.

593 estate dispensaries and 78 estate hospitals were supplied with free drugs during the year. A sum of Rs. 8,102.49 was realized by the sale of drugs in bulk to estates, and the cost of drugs issued free to estates was Rs. 193,914.49 during the year, as against Rs. 9,890 and Rs. 193,363.27 the previous year.

The building of storerooms to provide much needed additional accommodation was taken in hand during the year, and the staff was increased by the appointment of an additional temporary storekeeper.

44. *Opium*.—The number of opium depôts in the Island remained the same as during the previous year, namely, 53.

Forty-nine new consumers, as against 42 in 1923, were added to the register on purely medical grounds under section 11, sub-section (4), of Ordinance No. 5 of 1910; the total number of registered consumers served from the opium depôts in the Island during the year was 8,323, as against 8,647 in 1923, 9,908 in 1922, and 10,645 in 1921. 643 consumers obtained smoking opium in 1924, 666 in 1923. The number of vedaralas who purchased opium during the year was 2,673, as against 2,710 in 1923, and 2,812 in 1922.

4,053 lb. of eating opium and 474 $\frac{3}{4}$  lb. of smoking opium were sold to consumers and vedaralas during the year, as compared with 4,264 lb. and 566 lb., respectively, in 1923. This decrease in the sales during the year was due to deaths among consumers and vedaralas.

There was no change in the selling price of opium. Eating opium was sold at 1 $\frac{1}{2}$  cent per grain and smoking opium at 2 cents per grain.

The following is a statement of opium sold and amounts realized during the year 1924:—

Statement of Opium sold and amount realized during the Year 1924.

| During the Quarters ended. | Eating Opium.  |                   |    | Smoking Opium.    |                  |                  | Total realized.   |
|----------------------------|----------------|-------------------|----|-------------------|------------------|------------------|-------------------|
|                            | Quantity sold. | Amount realized.  |    | Quantity sold.    | Amount realized. |                  |                   |
|                            | Grains.        | Rs. c.            |    | Grains.           | Rs. c.           |                  | Rs. c.            |
| March 31, 1924             | ..             | 7,306,933         | .. | 109,720 27        | ..               | 884,200          | 127,404 27        |
| June 30, 1924              | ..             | 6,976,421         | .. | 104,756 43        | ..               | 837,850          | 121,513 43        |
| September 30, 1924         | ..             | 7,208,597         | .. | 108,238 32        | ..               | 813,025          | 124,498 82        |
| December 31, 1924          | ..             | 6,880,737         | .. | 103,326 64        | ..               | 788,950          | 119,105 64        |
| <b>Total for 1924</b>      | ..             | <b>28,372,688</b> | .. | <b>426,041 66</b> | ..               | <b>3,324,025</b> | <b>492,522 16</b> |
| <b>Total for 1923</b>      | ..             | <b>29,849,182</b> | .. | <b>448,198 8</b>  | ..               | <b>3,963,025</b> | <b>527,458 58</b> |

As a result of the large balance of 1,630 balls of opium brought forward at the end of 1923, no opium was imported from India during the year 1924. Of these 1,560 balls were converted into eating and smoking opium during the year, leaving a balance of 70 balls at the end of the year.

61 lb. and 4,639 grains of hard opium were received at the Government Opium Store during the year from the Principal Collector of Customs and from Police Magistrates in different parts of the Island. This quantity represents opium smuggled into the Island and seized by the Customs and the Police.

The amount realized by the sale of opium preparations during the year was Rs. 4,478·06, as against Rs. 4,936·60 in 1923.

45. *Medical Work in Connection with Railway Extensions*.—The general health of the labourers employed was satisfactory during the year. The following were the hospitals and dispensaries on the extensions:—Maho hospital, Habarana dispensary, Minneriya dispensary, Topawewa hospital, Mahaweli-ganga branch dispensary, Punanai dispensary, Oddaimavaddai dispensary, Kantalai hospital, Galoya dispensary, and Cod Bay dispensary on the Batticaloa-Trincomalee Railway Extensions and Madurankuli hospital and dispensary on the Puttalam Extension. Madurankuli hospital was closed on September 30, 1924, and Minneriya dispensary, Maho hospital and dispensary, and Habarana dispensary on November 30, 1924, as work on the sections served by these institutions were completed. The total number of patients treated in the Railway Extensions hospital was 3,502 with 152 deaths, as against 3,077 with 134 deaths the previous year. The mortality rate for 1924 was 4·34 per cent. For 1923, 4·35 per cent.

The principal causes of deaths were pneumonia 76, dysentery 20, and malaria 19. 35,727 cases paid 38,375 visits to the dispensaries during the year, as against 42,347 and 46,652, respectively, in 1923.

46. *Medical Inspection of Schools*.—The routine inspections of all the more important schools were carried out on the same lines as in previous years, individual pupils being examined in detail for any chronic disabling conditions. The number of schools examined was 72 boys' and 81 girls' schools, the total number of children being 3,570 boys and 5,209 girls. As in previous years, the most common disabilities in the children of urban schools were dental disease and defective vision, and in rural schools infection by hookworm and malaria. In the former case the degree of visual defect was rarely such as to interfere with the progress of the child in school, although in a few instances it exceeded 6/12 D. Less numerous and, yet perhaps, more serious among eye diseases met with, were cases of chronic follimbar catarrh, due largely to imperfect treatment of acute ophthalmia. These cases undoubtedly constitute the sources from which, under favourable conditions, serious epidemics of acute disease occur. Dental disease is becoming more numerous among school children, especially of urban areas; a large number of the cases have advanced to such a stage that no conservative treatment can be adopted; younger children go about with retained milk teeth on account of the difficulty of obtaining relief; many cases with early caries are frequently absent from school on account of attacks of pain. Dental treatment under existing conditions in Colombo and the outstations is beyond the means of the average parent; an extraction or a single filling costs as much as Rs. 5, and medical inspection of schools will never realize its full results until better facilities for treatment are provided by the State. The urgency exists only in the larger towns, and as soon as a central institution in Colombo is opened, it would be possible to arrange for occasional visits of a travelling clinic to smaller towns.

The problem of malaria among school children is part of the problem as it affects the whole Island. Side by side with the development of the sanitary part of the campaign, strong educational efforts must be made to secure the right response from the public. It is hardly likely that the anopheles mosquito will ever be exterminated from the Island, but it has been declared that "given sufficient quinine and a public ready to co-operate with the health authority, malaria may be got rid off in any part of the world." The suggestion here of course is that all human malaria-carriers can be sterilized, rendering the mosquito harmless in its relation to the disease. This implies that all persons infected with malaria should be

treated with quinine until the sufferer's blood is declared parasite free. A radical measure of this kind is bound to meet with considerable opposition unless the ground is prepared in the schools. It has been possible to control the epidemic incidence of smallpox by compulsory vaccination of all children before admission to school; in a similar manner some attempt at thorough treatment of all malaria carriers will have to be carried out in some of the more important Government schools situated in malarial districts.

Regarding hookworm, with the facilities now available both for examination and treatment, the severity of infection can be effectively controlled. Recently a sum of money was voted by Government for the erection of school latrines, and a plan providing a compartment for a bucket and an ablution chamber has been approved.

The propaganda of the hookworm campaign and the operations of the Directors have popularized the specific treatment in the schools, and it only remains now to ensure that the schools are regularly visited and the measures to prevent reinfection are perfected.

An unusual number of cases of itch was noticed in the Matara schools, and the infection has probably been carried to these schools from the neighbouring dry districts of Tangalla and Hambantota; lack of sufficient water for bathing purposes is undoubtedly one of the predisposing causes of the spread of this disease, but that factor hardly operates in Matara, where no doubt the ignorance of its parasitic and contagious nature favours its spread.

During the year a number of vernacular schools in the Western and Southern Provinces were visited in order to ascertain their sanitary condition and the kind of instruction that is given in hygiene. The buildings are mostly of the single-hall type with a low wall, some of them are paved and cemented; the old-fashioned long benches are everywhere in use, and in some the accommodation was seriously taxed; the sanitary conveniences consisted of a cesspit only in some of the schools.

Two periods a week are set apart for a class lesson on hygiene, and some elementary books are prescribed for study, but these lessons in several schools were lacking in detail and practical value, and in some instances the teacher was obviously ill-equipped for the task himself. Instruction in hygiene for children in these schools should be directed towards the cultivation of hygienic habits and demonstration in certain sanitary methods. It is the development of the "Sanitary Conscience" so neglected in these children and so vital to the sanitary progress of the country that should be promoted. The more backward the locality in which a school is situated the greater the care that should be paid to the sanitary details of the school and its equipment. The site, the locality, and the building, with its drainage, water supply, and sanitary conveniences should be such as to afford a permanent object-lesson in essentials; the cleanliness, repair, and equipment should always be above criticism. Such a standard will, however, not be attained unless specific conditions are laid down as to what is the minimum required before registration. The Code has laid down certain conditions relating to school buildings and their sanitary condition, which have to be complied with before registration; but they should be further amplified by insisting on provision being made for play-ground accommodation, water supply, and latrines, and these should be of a type that has the approval of the Education Department.

The work of the treatment clinics has continued during the year, the total number of cases at the Eye Hospital being 268 and at the Anti-Tuberculosis Institute 215. These children paid a total number of 724 and 713 visits, respectively, during the year. Of the 268 children treated at the Eye Hospital 140 were eye cases, 81 throat cases, 39 ear cases, and 8 nose cases.

The school nurse reports a distinct improvement in the health of the school children and that parents are less averse to treatment by minor operative measures. In some cases they will travel many miles to see the lady doctor at the school clinic.

In all some 8,779 children were medically examined and defects or ailments found in 1,963 of them, as against 8,588 and 2,158, respectively, the previous year.

**47. Medical Aid to Immigrant Coolies.**—The number of immigrants to Ceylon who passed through the Mandapam Dépôt during the year was 207,095—estate labourers 153,989 and miscellaneous passengers 53,106.

The following are the figures for the previous years, since the opening of the permanent camp in 1917:—

| Year. | Number of Immigrants passed. |                           |                   |
|-------|------------------------------|---------------------------|-------------------|
|       | Estate Labourers.            | Miscellaneous Passengers. | Total.            |
| 1917  | ..                           | 46,267 ..                 | 46,881 .. 93,148  |
| 1918  | ..                           | 44,010 ..                 | 41,431 .. 85,441  |
| 1919  | ..                           | 112,195 ..                | 53,360 .. 165,555 |
| 1920  | ..                           | 45,912 ..                 | 57,809 .. 103,721 |
| 1921  | ..                           | 25,344 ..                 | 52,132 .. 77,476  |
| 1922  | ..                           | 78,106 ..                 | 47,740 .. 125,846 |
| 1923  | ..                           | 90,289 ..                 | 42,240 .. 132,709 |
| 1924  | ..                           | 153,989 ..                | 53,106 .. 207,095 |

The year 1924 thus stands out as a record year as regards immigration to Ceylon. Over 10,000 labourers passed through this camp every month from March to September, the number dispatched during the four months April to July, viz., 91,135, alone exceeding the total for the twelve months of the previous year, viz., 90,289. This abnormally large increase may be attributed to unsatisfactory agricultural conditions akin to famine in many districts of South India, and also to the undoubtedly improvement in the conditions of labour in Ceylon. The accommodation in camp was taxed to its utmost during the busy season, the daily number of immigrants in quarantine reaching the high level of 8,000, and being maintained at that figure for some time. The maximum number of arrivals in camp on any one day was 1,609 on May 2, and the maximum number of departures to Ceylon on any one day was 2,184 on May 15. The highest number of estate labourers in camp was 8,261 on May 12. All twenty-five wards were fully occupied, accommodating 150 estate labourers each, and in addition twelve passenger wards, the arrival and departure wards, and the segregation wards were licensed by the protector of emigrants as places of accommodation for estate labourers.

Considerable difficulty was experienced during this period owing to the heavy daily dispatches to Ceylon having to be regulated according to the maximum carrying capacity of the ferry steamers. Extra steamer trips had to be arranged, and in some cases the detention of recruits in camp over and above the usual quarantine period became necessary. Extra detention in camp again became necessary in June owing to the restrictions on the Ceylon Government Railway caused by the heavy pilgrim traffic in the Island in connection with the Madhu festival. The ferry steamers again made two trips a day from Dhanushkodi, carrying the full complement of emigrants to Ceylon. The strike of firemen on the South Indian Railway and the unprecedented floods from the Cauvery river which occurred in June and July, respectively, did not effect the work of the camp to any serious extent. During the strike the South Indian Railway authorities ran special trains to convey the recruits from the camp to Dhanushkodi Pier and during the continuance of the floods a ferry service between Porto Novo and Nagapatam facilitated the transport of passengers and labourers to and from the agencies.

The roads and buildings in camp were maintained in a satisfactory condition throughout the year. An additional sea-water reservoir was built and bathing troughs completed for twenty-five wards. The railway siding at the camp station was entirely completed, the old trolley line being thereafter dismantled.

The following works at a cost of Rs. 60,000 have been sanctioned for 1925 :—

- (a) Covering the wells with wooden platforms in the residential and fresh water areas, and in the quarantine wards.
- (b) Extension of the fresh water supply by the addition of nine wells.
- (c) Extension of sewage outlet pipe No. 1 into the sea.
- (d) Improvements to outlet from sewage pit No. 3.
- (e) Providing drinking water at the Camp Railway Station.
- (f) Fencing the fresh-water area.
- (g) Two blocks of two units each as quarters for clerks.
- (h) Latrines for the attendants of the smallpox hospital.

The fresh water supply from the reservoir was of good quality. Owing to the very large number of estate labourers passing through the camp the supply had to be restricted and water from the superficial wells in the wards was used for washing and bathing purposes. In this connection twelve water coolies had to be employed from May to September. This relieved the situation to a great extent and ensured the use of a larger quantity of water for drinking and cooking. The extension of the water supply by the sinking of nine additional wells in the fresh water area will be taken in hand immediately.

Sea water is used for the flushing of latrines in camp, and the supply in the two reservoirs was ample throughout the year.

The lighting in camp has, as usual, been satisfactory. The Electrical Inspector of the Madras Government visited camp twice during the year.

The water-carriage system worked satisfactorily throughout the year. Improvements to the main outlet and to the outlet connected with the segregation wards have been sanctioned and are now in progress.

The sanitary condition of the camp has always been favourably commented upon by visitors, both official and non-official, the Sanitary Inspector and two camp overseers with their staff maintaining efficient supervision over the scavenging and disposal of rubbish and the daily disinfection of the buildings, latrines, and bathrooms. During the year a large Powell-Snodgrass type of incinerator was built, with a wind screen round it and a cement platform, in addition to the two existing incinerators of small size. During the busy season the incinerators worked day and night, and an additional rubbish cart was temporarily employed to remove the sweepings to the incinerators.

The sanitary brigade in connection with the Anti-Malarial Scheme did good work for four months of the year in filling up a large number of hollows and in treating stagnant pools with a mixture of liquid fuel and kerosene.

The total rainfall for the year amounted to 23.90 inches, which is 19.68 inches less than the previous year. The record since 1920 is given below :—

| Year. | Inches. | Year. | Inches. |
|-------|---------|-------|---------|
| 1920  | ..      | 1923  | ..      |
| 1921  | ..      | 1924  | ..      |
| 1922  | ..      | ..    | 43.58   |
|       | 44.47   | ..    | 23.90   |
|       | 26.63   |       |         |
|       | 29.64   |       |         |

October was the wettest month with a fall of 11.07 inches. The first quarter of the year registered 2.17 inches, the second quarter was the driest with a fall of only 0.38 inch, the third quarter registered 2.20 inches, while 19.15 inches of rain fell in the last three months of the year.

1,861 cases were dealt with during the year—

|  |       |    |    |
|--|-------|----|----|
| Rejection on medical grounds   | ..    | .. | 72 |
| Rejection by Protector of emigrants including claimed and refused cases. | 1,789 |    |    |
| Total ..   | 1,861 |    |    |

355 labourers recruited by the Ceylon Labour Commission were passed to Ceylon during the year. Forty-eight steamer crews were examined and passed after disinfection and vaccination. They arrived from Bombay and Calcutta and totalled 1,769.

A large number of casuarina and margosa and other shade trees have been planted during the year and are well looked after. They will in time replace the odai trees now growing in the quarantine wards and residential area of the camp.

During the year 24 cents per head per diem was the cost incurred by Government on 207,095 immigrants passed to Ceylon ; 26 cents per head per diem was the cost incurred by the Immigration Fund on 153,989 estate labourers and 17 cents each per diem was the cost incurred by 38,289 passengers who passed through the camp after full quarantine.

The health of the camp has been very satisfactory. An additional Assistant Medical Officer worked in camp during the busy season.

1,629 patients were treated in camp for malaria during the year, as against 1,569 the previous year. Of these, 605 cases occurred among the camp staff, as against 459 in 1923. 13,752 patients were treated at the camp dispensary, and they paid a total number of 22,008 visits. The number of out-patients treated and the total number of their visits in 1923 were 12,912 and 24,100, respectively. There were 84 deaths in camp during the year, including 58 deaths in the camp hospital ; of the 26 deaths in the camp 20 were among infants. 1,033 in-patients were treated, and the death rate for the year was 5.61, as against 980 and 2.14, respectively, the previous year. Of the deaths in hospital in 1924, 28 occurred within 48 hours of their admission. There were 11 cases of cholera, 10 among estate labourers with 8 deaths and 1 among passengers with 1 death, 6 cases of smallpox (no deaths), 28 of pneumonia with 7 deaths, and 77 of dysentery with 7 deaths. 126,421 primary and revaccinations were performed during the year ; and of these 59,494 were successful. The corresponding figures for the previous year were 98,698 and 40,265 respectively.

*Government Hospitals and Dispensaries in Planting Districts for Immigrant Coolies.*—There are 59 such hospitals with accommodation for 4,988 patients and staffed with medical officers, apothecaries, nurses, and attendants. Apart from the out-patient department attached to each of these hospitals there are 82 outdoor dispensaries in planting areas.

*Medical Inspection of Estates.*—The inspecting staff consisted of three inspecting medical officers and three assistants, and they visited a total number of 901 estates during the year out of 2,568 scheduled for inspection. Seventy-seven estate hospitals were inspected, and the estates they served received a rebate on the duty paid by each on the export of its produce in proportion to the marks gained at the inspection. The sum of Rs. 111,530 was paid by Government as rebate, under the provisions of section 27 of Ordinance No. 9 of 1912, from October, 1923, to September 30, 1924, as against Rs. 121,905 the previous financial year. The cost of construction, maintenance, equipment, and salaries of officers and employees of these hospitals are borne by the proprietors of estates. Free drugs to the value of 50 cents per annum for each labourer employed on the estate were issued to the estate hospitals and dispensaries and the total cost of these free issues during the year was Rs. 193,914.49, as against Rs. 193,363.27 the previous year. The majority of these hospitals and dispensaries are well constructed and well equipped ; the number of dispensaries on estates was 489.

The inspecting medical officers report that a large proportion of the estates have gradually added new lines in accordance with Government plans and specifications, and old lines were remodelled and reconstructed—wattle and daub walls were replaced with walls of brick or stone, lime plastered, and lime washed.

A new departure in the construction of estate lines is the building of walls with cement concrete, which is said to be cheaper than stone, cabook, or brick in the Colombo District.

Soil pollution still continues to some extent, and more latrine accommodation for coolies is needed on a fairly large number of estates.

Water supplies to lines have been improved. Deep wells properly built and steined and protected have replaced the old shallow unbuilt wells, and on some estates good water from a reliable source is piped to the lines.

The general health of immigrant coolies on estates is steadily improving as a result of better housing, the greatly improved sanitary condition of the lines, and line compounds ; satisfactory arrangements for medical aid and the care and attention paid to the cooly and his family by the managers or estates.

Expectant mothers, lying-in women, and non-working children are specially cared for, and free issues of rice to the former and cooked food once a day to the children are made on estate account.

48. The following is a list of medical and sanitary requirements for which provision has not yet been made :—

- (1) A Medical Research Institute. .
- (2) A Dental Institute.
- (3) The rebuilding of the Medical College, commencing with an up-to-date Physiological Laboratory, a Pathological Laboratory, and Museum.
- (4) A Fifth Surgeon, a Medical Registrar, and a Surgical Registrar for the General Hospital, Colombo.
- (5) Commencement of rebuilding of the non-paying section of the General Hospital, Colombo. The want of modern ward accommodation with clinical "side" rooms materially hampers the training of students, and the constant overcrowding shows the need for more accommodation for patients.
- (6) Many urgent additions and improvements to existing hospitals.
- (7) Several new dispensaries and hospitals for the inhabitants of outlying rural areas.
- (8) Suitable and sufficient office accommodation for the medical and sanitary branches of the department.

#### SECTION VII.—SCIENTIFIC.

49. *Government Bacteriological and Pasteur Institutes.*—Report of the Director, Dr. Lucius Nicholls, for the year 1924 :—

##### A.—BACTERIOLOGICAL INSTITUTE.

1. *Routine Work.*—The number of specimens examined during the year was 8,228. The fees which were received for the examination of specimens, not sent from Government institutions, amounted to Rs. 5,972.50 and were credited to revenue.

The character of the examinations carried out is shown in the following table :—

| Specimens.                              | Official.    | Private.   | Total.       | Positive. | Negative. |
|---|--------------|------------|--------------|-----------|-----------|
| Blood for typhoid (widal)               | 1,792        | 42         | 1,834        | 861       | 973       |
| Blood for paratyphoid A (widal)         | 389          | 18         | 407          | 16        | 391       |
| Blood for paratyphoid B (widal)         | 389          | 17         | 406          | —         | 406       |
| Blood for malaria                       | 85           | 13         | 98           | 21        | 77        |
| Blood for filaria                       | 1            | —          | 1            | —         | 1         |
| Blood for Wassermann test               | 1,442        | 177        | 1,619        | 754       | 863       |
| Scraping for spirochætes                | —            | 7          | 7            | 2         | 5         |
| Sputum for tubercle bacilli             | 86           | 49         | 135          | 30        | 105       |
| Milk for tubercle bacilli               | —            | 2          | 2            | —         | 2         |
| Urine for tubercle bacilli              | 3            | —          | 3            | —         | 3         |
| Urine for <i>B. typhosus</i>            | —            | 1          | 1            | —         | 1         |
| Fæces for <i>B. typhosus</i>            | 1            | —          | 1            | —         | 1         |
| Bile for <i>typhosus</i>                | 2            | —          | 2            | —         | 2         |
| Secretions for gonococci                | 97           | 6          | 103          | 21        | 82        |
| Urine for gonococci                     | 1            | 1          | 2            | —         | 2         |
| Urine for bacteriological examination   | 34           | 4          | 38           | —         | —         |
| Urine for chemical examination          | 43           | 6          | 49           | —         | —         |
| Sputum for pneumococci                  | 5            | —          | 5            | 3         | 2         |
| Rats for <i>B. pestis</i>               | 962          | —          | 962          | —         | 962       |
| Human material for <i>B. pestis</i>     | 71           | —          | 71           | 15        | 56        |
| Secretions for <i>B. diphtheriae</i>    | 132          | 17         | 149          | 34        | 115       |
| Secretions for <i>B. lepræ</i>          | 23           | —          | 23           | 8         | 15        |
| Fæces for amœbæ                         | 49           | 141        | 190          | 59        | 131       |
| Fæces for <i>B. dysenteriae</i>         | 21           | 1          | 22           | 6         | 16        |
| Fæces for ova anky., &c.                | 11           | 22         | 33           | 14        | 19        |
| Fæces for microscopical examination     | 4            | 6          | 10           | —         | —         |
| Fæces for bacteriological examination   | 5            | —          | 5            | —         | —         |
| Evacuations for cholera vibrie          | 41           | —          | 41           | 11        | 30        |
| Cerebro-spinal fluid for examination    | 2            | —          | 2            | —         | —         |
| Tumour for examination                  | 4            | —          | 4            | —         | —         |
| Miscellaneous specimens for examination | 64           | 9          | 73           | —         | —         |
| Water for examination                   | 72           | 11         | 83           | —         | —         |
| Auto-vaccine                            | 35           | 14         | 49           | —         | —         |
| Anti-typhoid vaccine (doses)            | 524          | 17         | 541          | —         | —         |
| Gonococcal vaccine (doses)              | 1,101        | —          | 1,101        | —         | —         |
| Staphylococcal vaccine                  | 60           | 10         | 70           | —         | —         |
| Mixed vaccine                           | 36           | 50         | 86           | —         | —         |
| <b>Total</b>                            | <b>7,587</b> | <b>641</b> | <b>8,228</b> | <b>—</b>  | <b>—</b>  |

*The Bacteriological Examination of Water.*—Samples from eighty-three different sources were examined during the year.

On several occasions during past years a sample has been received at this laboratory and has been of excellent quality, and at a later date another sample has been received from the same source and has been condemned as unfit for human consumption.

Because such results as these have been considered extraordinary by the senders of samples, it appears that misapprehensions and hazy ideas exist as to the meaning and value of bacteriological and chemical examinations of water for drinking purposes.

It should be understood that the result of the examination of one or more samples from any water supply is only of value when it is considered in conjunction with the thorough inspection of the source of the supply, such as the catchment area, by a sanitary expert.

The contamination of the water supplies is usually intermittent, and even when half a dozen or more samples from a supply have been found to be chemically or bacteriologically pure, very little reliance can be placed upon this unless the catchment area of the supply is properly conserved.

A water may be bacteriologically pure for 99 days, and on the 100th day excessive rains or some other adventitious occurrence may cause contamination of the water supply. The following is a good example of this :—

The water supply of Diyatalawa was examined on two occasions and found to be bacteriologically pure. After heavy rains the same supply was found to be teeming with "fæcal" bacteria. It was discovered that during these rains the drainage from the coolie lines and a tea estate was washed into the supply. In other words, the catchment area was not properly conserved, and yet during dry weather the water percolated sufficiently through the earth for natural filtration to purify it. In this case the Military Authorities had relied on the early chemical and bacteriological examinations and were misled as to the purity of the water.

It is desirable especially in the case of expensive town installations of water supplies that the Bacteriologist should visit the catchment areas with the Engineer, and collect the samples himself. It is important that the Bacteriologist who examine samples of water should have first-hand knowledge of the sources of them.

**2. Research Work.**—During the year the Ceylon Journal of Science came into existence, and the Medical Section of this paper is edited by the Director of this Institute. Any research work of importance which is carried out at this Institute will be published in this journal.

A paper on "Aberrant forms of *B. typhosus*" by Mr. Burgess, and a paper on the treatment of Leprosy have already been published.

2. Much work was done during 1924 on the morphology of bacteria when they are growing under various circumstances such as when growing on 3 per cent. salt agar, or on salt free agar. It was found that many organisms could be quickly recognized by this method of comparing their morphological appearances on two or more media. Papers on this subject are now in the press.

3. Work was done on the development of "local" immunity to *B. pestis* and *B. anthracis*. Various vaccines suitable for administration by the mouth or application to the skin were prepared from these organisms, and attempts were made to immunize rabbits and guinea-pigs by feeding the vaccines to them or rubbing the vaccines into the skin. But as far as these organisms are concerned, immunity sufficient to protect the animals from plague or anthrax did not develop in a single rabbit or guinea-pig. The details of this work are being published in the number of the Ceylon Journal of Science which is in the press.

4. Work was done on *B. pyocyaneus*. This organism appears to be pathogenic under three circumstances :—

- (a) As a secondary invader after such diseases as typhoid. The best example of this was a case of pericarditis following typhoid in which the organism was present in pure culture.
- (b) In cases of cholecystitis. Dr. Grenier has sent to this laboratory a number of specimens which have been obtained from a duodenal tube. The specimens have contained *B. pyocyaneus*. And in two cases when the symptoms have abated and the patients had returned to normal health *B. pyocyaneus* ceased to be present in the duodenal fluid.
- (c) *B. pyocyaneus* has been isolated on a number of occasions from light coloured choleraic like contents of the ileum which have been obtained from patients who have died suddenly with symptoms resembling cholera. We have never isolated *B. pyocyaneus* from cases of cholera when the *V. cholerae* has been present.

It appears probable that in Ceylon there exists an acute intestinal disease closely resembling cholera, but which is due to a highly virulent strain of *B. pyocyaneus*.

5. Another organism which requires further investigation is one which closely resembles *B. diphtheriae* and which has been isolated from chronic ulcers of the leg and from a peculiar type of throat ulceration.

#### B.—PASTEUR INSTITUTE.

During 1924, 398 patients were treated for dog bites. Besides these a large number of persons sought advice at the Institute.

The Provinces from which these patients came are as follows :—

| Province.     | Number. | Province.     | Number. |
|---------------|---------|---------------|---------|
| Western       | 189     | Southern      | 7       |
| Central       | 86      | North-Central | 2       |
| Northern      | 56      | Eastern       | 1       |
| Sabaragamuwa  | 35      |               |         |
| North-Western | 12      | Total         | 398     |
| Uva           | 10      |               |         |

The racial classification of these patients is as follows :—

|               |     |         |     |
|---------------|-----|---------|-----|
| Sinhalese     | 193 | Muslims | 9   |
| Indian Tamils | 81  | Parsees | 1   |
| Ceylon Tamils | 54  |         |     |
| Europeans     | 33  | Total   | 398 |
| Burghers      | 27  |         |     |

The number of patients who have been admitted for treatment at the Institute since its opening up to the end of 1923 is 1,777, and 21 of these have died of hydrophobia. This is 1.18 per cent. of failures.

The following chart was prepared to discover whether or not there was any seasonal incidence in the number of persons who are bitten by dogs. The chart shows that throughout the year there is very little difference in the number of persons who apply for treatment each month :—

| Year. | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Total. |
|-------|------|------|------|--------|------|-------|-------|------|-------|------|------|------|--------|
| 1919  | 69   | 51   | 56   | 45     | 46   | 42    | 19    | 31   | 43    | 42   | 45   | 33   | 522    |
| 1920  | 20   | 11   | 23   | 39     | 16   | 33    | 45    | 16   | 13    | 23   | 6    | 27   | 272    |
| 1921  | 18   | 30   | 16   | 15     | 18   | 15    | 13    | 32   | 8     | 13   | 31   | 40   | 249    |
| 1922  | 22   | 8    | 9    | 19     | 11   | 8     | 11    | 27   | 35    | 21   | 22   | 14   | 207    |
| 1923  | 10   | 21   | 31   | 10     | 19   | 27    | 53    | 37   | 20    | 34   | 55   | 19   | 336    |
| 1924  | 29   | 24   | 15   | 22     | 55   | 38    | 37    | 54   | 24    | 28   | 28   | 44   | 398    |
|       | 168  | 145  | 150  | 150    | 165  | 163   | 178   | 197  | 143   | 161  | 187  | 177  | 1,984  |
|       | —    | —    | —    | —      | —    | —     | —     | —    | —     | —    | —    | —    | —      |

50. Summary of results of research work done in the Municipal Bacteriological Laboratory during 1924 by Dr. L. Fabian Hirst, Municipal Bacteriologist, Colombo :—

(1) The flea survey of Colombo was completed. The total number of fleas examined in the course of the survey was 10,994 taken from 3,331 rats of all species.

The town was divided into fifteen districts, including the Customs premises and Government granaries.

The co-efficient of correlation between percentage *Xenopsylla cheopis* to total rat fleas and human plague incidence per 10,000 of population in the fourteen inhabited districts was .95 probable error .02. The various factors which might produce a spurious correlation between cheopis prevalence and plague incidence were separately examined. The results were negative.

Similarly a most striking agreement was disclosed between the actual distribution of cheopis infested premises and the situation of premises where plague rats were found.

The following are the results of the flea survey of the Customs premises and Government granaries :—

#### March, 1923.

|   | Rats. | Fleas. | Astia. | Cheopis. | Per Cent. Cheopis. | Flea Index. |
|---|-------|--------|--------|----------|--------------------|-------------|
| Customs premises and Government granaries | 43    | 98     | 41     | 57       | 58.2               | 2.3         |

#### November, 1923, to March, 1924.

|                      |    |     |    |     |      |     |
|----------------------|----|-----|----|-----|------|-----|
| Customs premises     | 30 | 144 | 32 | 112 | 77.8 | 4.8 |
| Government granaries | 38 | 112 | 33 | 79  | 70.5 | 2.9 |

#### March to December, 1924.

|                      |     |     |    |     |      |      |
|----------------------|-----|-----|----|-----|------|------|
| Customs premises     | 99  | 213 | 42 | 171 | 80.3 | 2.15 |
| Government granaries | 136 | 170 | 40 | 130 | 76.5 | 1.25 |

The above results show that the percentage of *Xenopsylla cheopis* found on rats in the Government granaries and Customs premises is much higher than elsewhere. An equally high proportion of *X. cheopis* is found on rats caught in the Municipal grain boutiques.

The *X. cheopis* found during the flea survey on the rats of Fourth Cross street, where much grain other than rice is stored, were 45·9 per cent. of 274 fleas. During the epizootic of rat plague which took place in that street during November, 1923, the proportion of *X. cheopis* rose to 80 per cent.

The rats caught in Bankshall street, which also contain much imported grain, during the flea survey harboured 44·8 per cent. *X. cheopis* out of a total of 58 fleas.

The proportion of *X. cheopis* in the outlying markets at Dean's road and Nagalagam street, where a strictly limited amount of grain is permitted to be stored, was 7 to 8 per cent. In the outlying districts of the town the percentage of *X. cheopis* varied from 2 to nil. When *X. cheopis* occurs elsewhere it is frequently found that bags of grain or cattle fodder have recently been brought from the Pettah stores to the infested premises.

*Comparative Experiments on the Transmission of Plague from Rat to Rat by means of *X. astia* and *X. cheopis*.*

(1) Attempts to transmit plague between rodents have been carried out with 596 *X. astia* in the course of thirteen experiments during four plague seasons at room temperature in this laboratory. The results were entirely negative.

(2) Under similar conditions 132 *X. cheopis* transmitted plague to twelve rodents in the course of six separate experiments.

(3) Plague has been transmitted from rat to rat by means of *X. astia* in one experiment carried out at an artificially reduced temperature in a transmission chamber surrounded by a mixture of ice and sawdust. One infective *astia* was found to be typically "blocked" and exhibited the phenomenon of oesophageal regurgitation described by Martin and Bacot. Two other experiments on the same lines gave negative results. In other words, *X. astia* may carry plague of rats, under climatic conditions favourable to plague transmission.

(4) Contrary to my expectations, plague was continuously transmitted to a series of rats in succession by the same batch of infected *X. cheopis* at room temperature during March, 1924, under climatic conditions particularly unfavourable to plague transmission.

(5) It is comparatively easy to obtain heavy growth of plague in the stomach of *X. astia* fed upon infected plague rats. There is evidence, however, that blocked *astia* have relatively low vitality and bite rats, but feebly at tropical temperatures.

(6) No evidence has yet been obtained of any marked difference in the virulence of *B. pestis* after growth in the stomach of *X. astia* and *X. cheopis* respectively.

51. Spinal Analgesia by Dr. Lucian de Zilwa, Physician, General Hospital, Colombo :—

In November, 1922, I did my first operation with spinal analgesia caused by injecting a bulb of stovaine into the spinal canal in the lumbar region. Since then all major operations have, whenever possible, been done under stovaine. In 1922, 12 operations were done under stovaine; in 1923, 67; and in 1924, 145. The smallness of the earlier figures is explained by the difficulty in obtaining stovaine in sufficient quantity. The almost total prevention of shock, and the completeness of abdominal relaxation with a localized anaesthesia, make stovaine an ideal anaesthetic for major operations. It is not given for minor operations like curettage of the uterus. Only in one instance was there a misadventure, where the patient lay down almost immediately after the injection had been given. Since then particular care has been taken to keep the patient either seated, or with head and neck elevated for ten minutes after the injection.

In 14 of the above 224 cases of spinal analgesia it was found necessary to administer a little chloroform, either because the patient was nervous in spite of being analgesic or because at the end of a long operation there were indications of a recovery of sensibility. In 4 cases no analgesia was produced although two bulbs of stovaine had been injected into the spinal canal. One of these women admitted drinking about 2 bottles of arrack daily.

In none of the cases were there any unpleasant effects observed. Even the severe headache, on which much stress is laid in the literature, was only noted in 4 of the patients.

*Some Surgical Innovations.*

Since my return from long leave in 1922, I have, following the practice in some of the Berlin hospitals, given up the use of cotton wool pads and many-tailed bandages in abdominal operations. All clean wounds are simply dressed with gauze and collodion. This is both economical and pleasant to the patient, who is spared the heat and discomfort of the old dressings.

All abdominal cases, provided they have no fever, are made to sit up on the second day after operation, and to get down into a deck chair on the third day. The convalescence is wonderfully hastened. No lung complications or bed-sores occur; the patients' appetites are good; and at the end of the tenth day they are fit to leave hospital. Formerly we used to keep a patient in bed a fortnight, and she was weak and shaky on getting up, even if she had been fortunate enough to escape any complications.

There were 12 cases of ectopic pregnancy in 1924: 8 of these involved the left tube. Two were cases of tubal abortion, and 1 was an ovarian pregnancy of the right side. One patient, who had been operated on in July, 1923, for a ruptured ectopic pregnancy of the right tube was operated a year later for an ectopic of the left tube. A living three months' foetus was removed from the left broad ligament, and movements were observed for several minutes.

There were 2 cases of uterus bicornis, with accumulation of blood in the rudimentary horn. One of these had a ruptured tube on the opposite side.

Cancer of the uterus, Wertheim's operation is done in selected cases. But the majority of patients are too far advanced for operation. It is hoped that X-rays or radium may be available for these cases.

52. A brief résumé of a few interesting cases by Dr. A. M. de Silva, Surgeon, General Hospital Colombo :—

*Intestinal Obstruction due to a Meichel's Diverticulum* which was gangrenous. In this case the Meichel's diverticulum had formed a noose round a coil of small intestines and tightly constricted it producing acute obstruction—the end of the diverticulum was firmly attached to the mesentery. The whole of the diverticulum together with a portion of intestine to which it was attached was gangrenous. The gangrenous portion was resected and intestinal anastomosis done. The patient made an uninterrupted recovery.

*Intestinal Obstruction due to the Vermiform Appendix.*—A somewhat similar case only in this patient the appendix formed the band and was not gangrenous. It was acutely inflamed and firmly attached to the mesentery of the ileum. A loop of small gut was tightly constricted by it and on relieving the obstruction small patches of gangrene were found in the constricted area which were invaginated by purse-string sutures. The patient made an uneventful recovery.

*Goitre*.—Ten operations were performed for this during the year. Eight of these were for adenomata and 2 for exophthalmic goitre. Five of them were males and 5 females. Goitres of all varieties seem to be just as common in males as females in Ceylon. *Parenchymatous goitres* were frequently met with both in boys and girls in association with enlarged tonsils and adenoids in these patients when the tonsils and adenoids were removed the goitre markedly diminished in size and in no case was operative treatment required for the goitre.

*Lingual Goitre*.—Lingual goitres are rare. The tumour was removed from an adult male age 28 by an incision in the middle line of the neck extending from the symphysis to the hyoid. The tumour was just in front of the epiglottis immediately under the mucous membrane projecting into the pharynx and obstructing the laryngeal orifice. It was of the size of a mandarine orange. It was very vascular—a solid adenoma. Preliminary laryngotomy and tracheotomy were done as there was no palpable thyroid in the normal site, a small part of the tumour was left behind to prevent the superventure of myxoedema. The patient although complaining of dyspnoea for a few days after the operation made an uneventful recovery and left hospital greatly relieved.

*Sacrococcygeal Tumour*.—A very large sacro-coccygeal tumour was successfully removed from an adult male—it was present from birth and was of the nature of teratoma. There was no communication with the spinal canal.

*Meningocele*.—A large meningocele was removed from an infant eight days old. The tumour was much larger than the infant's skull, the skin over it was thin, atrophic, and ulcerated in places. It was attached to the skull at the external occipital protuberance and communicated with the fourth ventricle. After operation the infant seemed to be getting on well, but died on the eighth day with signs of meningitis.

*Granuloma of Nose causing complete Occlusion of both Nasal Cavities*.—Two cases were operated on during the year, one an adult male and the other a female. Both nostrils were completely occluded by hard firm granulation tissue of many years' duration. This tissue projected outside the nasal prominences on to the face disfiguring the patient, filled up both nasal cavities completely and also the naso-pharynx-nasal breathing was absolutely impossible, the mouth was kept constantly open. Although the tissue removed was carefully examined microscopically and bacteriologically the cause of this rare condition could not be ascertained. Wassermann reaction was negative, but in spite of this, injections of salvarsan were administered without any appreciable improvement in their conditions. The operations consisted in burrowing two tracts through the dense granulomatous masses and introducing drainage tubes thus restoring nasal breathing. On removal of the tube the tracts tend to close, so that they were kept in and the patients discharged with the tubes *in situ*.

*Splenectomy* was performed three times during the year for chronic malaria—the largest spleen removed weighing 8½ lb.

*Internal Ear*.—Two operations were successfully performed on the labyrinth for suppuration extending to this region. After the usual radical mastoid, the lateral sinus was exposed and the bone in the angle between the external semicircular canal and facial canal was chiselled into until the external semicircular canal, vestibule posterior semicircular canal and cochlear opened up. In both cases the discharge ceased after the operation.

*Cancer*.—The number of cases of this complaint admitted to the wards seems increasing every year, and unfortunately the majority of cases in an inoperable stage. In some of these inoperable cases Bell's treatment (raw vegetable juices and injections of sodium cacodylate) was tried, certainly with beneficial results though in no case had a definite cure resulted.

*Injury to the Thoracic Duct in the Thorax*.—This was a result of a stab wound on the left side at the level of the eighth dorsal vertebra. The patient—a lady—three months pregnant was assaulted at Badulla, where she was treated for the first few days. When admitted to the General Hospital the external wound was completely healed, but there were signs of free fluid in the pleural (left) and peritoneal cavities, causing severe dyspnoea. On aspirating these cavities large quantities of chylus fluid were removed. But the fluid both in pleural and peritoneal cavities quickly reappeared (within a day or two) so that repeated tappings were necessary. The pleural cavity was aspirated more than a dozen times and the abdominal cavity was also tapped about an equal number of times. After each tapping she was greatly relieved, but the fluid speedily recurred and she also aborted whilst in hospital. As tappings were required so frequently I was obliged to make a permanent opening in the thorax by resecting a portion of a rib. Although the patient was greatly relieved by this operation—the fluid ceasing to accumulate in both pleural and peritoneal cavities—she had a sinus discharging chyle continuously and was wasting rapidly. In spite of regulation of diet, &c., she continued to lose flesh and eventually died in a comatose condition several months after the original assault.

*Reductio en Masse (Strangulated Hernia)*.—One case of *Reductio en Masse* was operated on during the year. The remarkable feature about this case was that the patient himself produced the *Reductio en Masse*. The hernia which was previously reducible came down and got strangulated and he was seized with violent pain and vomiting. In desperation he squeezed the whole forcibly inside the abdominal cavity—only to find that although the external swelling had completely vanished there was absolutely no relief to his symptoms—the pain was even more severe than before, and the vomiting continued. At the operation it was found that the *Reductio en Masse* was of the Recto-Peritoneal type (the sac with its contents lying between the iliac fascia and peritoneum) and the intestine was gangrenous in places. After operation patient made an uneventful recovery.

53. Some important factors in the causation of Diabetes Mellitus in Ceylon (based on a brief survey of 200 selected cases), by Dr. Lionel de Silva, Physician, General Hospital, Colombo:—

Funck has rightly stated that the diagnosis of Diabetes Mellitus means no more than the diagnosis of fever. The chief manifestations of this disease have been recognized since the days of Celsus, and it is said that Aræteus in 150 A.D. was the first to call this syndrome of compleætiology "Diabetes Mellitus."

Attempts have been made from time to time to regard diabetes as a definite disease, but the researches on the bio-chemistry of the blood and urine during the last decade have proved the correctness of Solis-Cohen's dictum "I do not know of any definite disease called Diabetes Mellitus."

Hindu medical literature of the sixth century refers to this disease "Madhumeha" or honey urine, and describes it so vividly that Chander Bose's translation seems worthy of repetition.

Madhumeha is a disease which the rich principally suffer from, and is brought on by their over-indulgence in rich flour and sugar. The patient feels weak and emaciated and complains of frequent micturition, thirst, and prostration, ants flock round his urine, carbuncles and phthisis are its frequent complications. This classical description adequately described the state of the diabetic in Ceylon to-day.

Careful observation and improved technique have enabled us to investigate further as to whether it is the liver, stomach, kidney, pancreas, or the nervous system which refuses first to respond to the constant strain of over-indulgence in food, alcohol, &c. The somewhat premature enthusiasm of the lay press over

the valuable discovery of insulin has unfortunately created an atmosphere of optimism among sufferers, who seem to ignore the fact that several causes, operating individually or collectively may give rise to these common symptoms which go under the somewhat unfortunate term "Diabetes."

An aetiological survey of 200 cases based on clinical and bio-chemical observations during the last four years showed primary pancreatic involvement in only 4 cases.

Age when disease was first recognized :—

Ninety out of 200 were just under 40 years.  
 Seventy-six out of 200 were between 40 and 50 years.  
 Twenty-three out of 200 were between 50 and 60 years.  
 Eleven out of 200 were over 60 years.

The average age incidence of the cases under 40 years was 38 years.

It is worthy of note that the first appearance of this disease in the majority of cases in this series is much earlier than almost all other countries, including India. In European countries, especially in Southern Europe, the average age incidence has been 50 years.

In Dr. Bose's series of 325 cases the majority of patients were over 40. This higher age incidence in India may be due to the fact that the individual Ceylonese is relatively more prosperous than his brother in India.

*Race*.—Race distribution in this series of 200 cases :—

|              |     |              |    |
|--------------|-----|--------------|----|
| Sinhalese .. | 108 | Tamils ..    | 22 |
| Muslims ..   | 54  | Europeans .. | 2  |
| Burghers ..  | 8   | Others ..    | 6  |

Without reference to the statistics of the older and more experienced medical men throughout this Island, no definite inference could be drawn from the above figures beyond a further confirmation of a current belief that a very considerable proportion of the Muslims in Ceylon are diabetic.

*Sex*.—156 males, 44 females.

Observers in other countries have also noticed the greater susceptibility of males to this disease.

Sereges series—390 males, 90 females.

*Heredity*.—A definite diabetic family history was obtained in 53 cases in this series, *i.e.*, 25 per cent.

Strauss of Berlin had 21 per cent. cases with diabetic family history ; Non Noorden had 18 per cent. cases with diabetic family ; Serege of Vichy had 25 per cent. cases with diabetic family ; Mitchell had 46.6 per cent. cases with diabetic family. Sixty-five per cent. of Mitchell's patients were Jews.

Over-indulgence in rice, fruits, sweets accounted for over 70 per cent. of cases.

A history of sedentary habits was obtained in as many as 90 per cent. of cases.

A history of alcoholic excess was obtained in about 20 per cent. of cases, and in most of these cases it was interesting to note that there was no history of excess in the ingestion of sweets and fruits.

The liver seems to be the first and chief organ which seems to object to the self-indulgence of the potential diabetic.

The stages in the life history of the average diabetic in Ceylon may be summed up as follows :—

- (a) Material prosperity.
- (b) Over-feeding by parents ; excessive indulgence in rich food and sweets.
- (c) Sedentary occupation.
- (d) Suralimentation leading to hepatic congestion.
- (e) Occasional glycosurias due to hepatic insufficiency and in some cases excessive functional activity of the liver.
- (f) Constipation and often haemorrhoids become well-marked features in the case.
- (g) Persistent glycosuria with hepatic lesions. This is the stage at which the physician is first consulted.
- (h) Case becomes a diabetic without denutrition, suralimentation still continued. Liver slightly enlarged, high blood pressure and venal scleriosis. Patient eventually dies of uræmia. Average expectation of life seems to be about ten to fifteen years from onset of symptoms.
- (i) Patient may become a diabetic with denutrition. Hepatopancreatic cirrhoses with serious diabetes develops, about 5 per cent. of cases in this series.

54. A summary of the work done in the Pathological Department, General Hospital, Colombo, by Dr. W. A. E. Karunaratne, Pathologist :—

During the year the following specimens were sent for examination and report :—

|               |   |    |    |       |       |
|---------------|---|----|----|-------|-------|
| <i>Urine</i>  | Full report ..                                      | .. | .. | 2,588 | 4,008 |
|               | Special examination ..                              | .. | .. | 1,387 |       |
|               | Diastase reaction ..                                | .. | .. | 33    |       |
| <i>Sputum</i> | For tubercle bacilli, &c.                           | .. | .. | 1,611 |       |
| <i>Fæces</i>  | For ova, amœbæ, cysts, &c.                          | .. | .. | 1,649 |       |
|               | Malarial parasites ..                               | .. | .. | 583   |       |
|               | Filaria ..  | .. | .. | 43    |       |
|               | Leishman donavan bodies ..                          | .. | .. | 6     |       |
|               | B. Pestis ..  | .. | .. | 169   | 1,449 |
|               | Blood counts, &c. ..                                | .. | .. | 618   |       |
|               | Estimation of sugar ..                              | .. | .. | 18    |       |
|               | Vandenberg's test ..                                | .. | .. | 12    |       |
|               | Cerebro spinal, pleuratic and peritoneal glands ..  | .. | .. | 100   |       |
|               | Analysis of gastric contents after test meals ..    | .. | .. | 87    |       |
|               | Smears for gonococci, lepra bacilli, spirochætes .. | .. | .. | 119   |       |
|               |   |    |    |       | 9,023 |

#### *Report on Specimens from Operating Theatre and from Outstation Hospitals.*

Reports were made on 352 specimens, made up as follows :—

|                         |    |    |     |     |
|-------------------------|----|----|-----|-----|
| Operating theatre ..    | .. | .. | 250 | 352 |
| Outstation hospitals .. | .. | .. | 31  |     |
| Post-mortems ..         | .. | .. | 71  |     |

*Post-mortems.*—253 post-mortems were held during the year—some of them were of much pathological interest. Amongst these were the following :—

- (1) A case of generalized tuberculosis where miliary tubercles were found in all the organs with the exception of the heart.
- (2) A case of carcinoma of the gall bladder associated with gall stones. Practically the whole of the fundus was replaced by a growth which in parts showed areas of breaking down necrotic tissue—the remainder of the cavity was full of pus and in this 8 gall stones were found. The right lobe of the liver was enlarged and there was an exudation of fibrin on the surface.
- (3) A case of carcinoma of the liver where the organs weighed 21 lb. The liver was studded with nodules of growth of various sizes. The primary growth was on the head of the pancreas.
- (4) A case of “Tropical abscess” of the liver where the liver weighed 10 lb. There were several abscess cavities full of greenish-yellow “pus.”
- (5) A case of sarcoma of both ovaries. The Fallopian tubes were infiltrated by growth, but there was no growth in the uterus. Each tumour was about the size of an orange. The histological structure was that of a round celled sarcoma.
- (6) A case of hydrocephalus where the two hemispheres were represented by two greatly distended lateral ventricles bounded by a thin layer of cerebral substance. The condition was secondary to an endothelioma at the base of the brain.
- (7) A case of sarcoma of the vulva with multiple secondary growths in various organs, viz., liver-mesenteric glands-lungs-chest wall. The whole of the pelvic cavity was filled by a mass of growth.
- (8) A case of myeloid Leukæmia showing a collection of “pus” in the left frontal lobe.
- (9) A case of combined typhoid fever and amoebic dysentery. Typhoid lesions were present on the small intestine, while the large intestine showed the lesions characteristic of amoebic dysentery.

55. *Splenectomy, Intestinal Obstruction due to Worms, Extra Uterine Pregnancy, and Perforated Typhoid Ulcer with Peritonitis, by Dr. Catherine E. Anderson, Medical Officer in Charge, Lady Havelock Hospital for Women, and Lady Ridgeway Hospital for Children, Colombo.*

*Case i.*—Joseph, aged 8 years, a resident of Ambepussa, was admitted into the Lady Ridgeway Hospital on June 9, 1924, with enlargement of abdomen and a history of intermittent fever for 2 years. On examination the spleen was found to be filling up the whole of the left side of the abdomen and extending across the middle line one inch to the right of the umbilicus and below down to the symphysis pubis. Blood filler showed malaria parasites. Also a course of iron and arsenic and quinine treatment. Splenectomy was done on July 4, 1924. Spleen weighing  $1\frac{3}{4}$  lb. was removed through a vertical incision through the left recties. He made an uninterrupted recovery and was discharged fit on August 21, 1924.

*Case ii.*—Caroline, aged 5 years (Sinhalese) was admitted into the Lady Ridgeway Hospital on November 17, 1924, with a history of attacks of abdominal pain and vomiting and fever for 5 days, also the passage of only blood and mucus per rectum. The mother said she noticed a “lump” appearing in the abdomen from time to time. On admission temperature was  $100^{\circ}$ , pulse 140, a tumour could be felt extending from under the right costal margin across the abdomen above the umbilicus to the left hypochondriac region. Several enemas were given and only blood and mucus were passed per rectum. Diagnosis of obstruction high up in the small intestine was made due to intussusception or possibly Ascaris lumbricoides. Laporatomy was done on the evening of admission through a vertical incision through the right rectus. About 18 inches of the jejunum was found to be packed by a solid mess of round worms. It was found impossible to “milk” them down the bowel so enterotomy was done. Through this the worms, numbering about 800, were removed in messes by means of forceps—the worms being “worked” towards the aperture in the bowel until the whole mess was evacuated. A double row of silk suture closed the bowel and the abdomen was sutured up in the usual way. Saline and glucose per rectum were given for the next 24 hours. On November 19, 1924 (i.e., two days after the operation),  $\frac{1}{2}$  gr. of santonine preceded and followed by oil ricini were given, but no worms were passed.

On November 20, 1924, the child passed a normal motion. Apart from a little suppuration at the lower part of the skin wound the child made an uneventful recovery on December 6, 1924, round worm ova were found in the faeces. On December 7, 1924, carbon tetrachloride (m vii) was given to remove any hookworm that may be present.

Before the child left hospital santonine and oil of chenopodium were administered, but no round worms were passed. She left hospital on January 15 perfectly well.

*Case iii.*—A Sinhalese lady, aged 34, was admitted into the Lady Havelock Hospital on October 3, 1924, giving a history that she was 10 months pregnant and had no signs of labour pains. Breast signs were absent. She said she had amenorrhœa for six months and after that bleeding off and on for the last four months.

On admission a solid hard lobulated tumour was found filling up the lower abdomen and extending to a level one inch above the umbilicus on the left side. On the right and continuous with the tumour was a hard nodule.

She had 3 children, the youngest being 10 years old. Leparotomy was done the day after admission and a tumour consisting of a six months’ dead foetus were removed with great difficulty enclosed in a sac formed by the layers of the broad ligament. Omentum and bowel were firmly adherent which made the operation exceedingly difficult. As it was impossible to separate the tumour from the uterus a subtotal hysterectomy was done—the tumour being firmly attached to the left side of uterus. The nodule that was felt abdominally was the fundus of the uterus. Remains of the tube and ovary were found on the upper surface of the tumour. This then had been a case of tubal gestation with extra peritoneal rupture between the layers of the broad ligament, i.e., an intraligamentary rupture with survival of the foetus up to six months. Death of the foetus took place four months previous to admission, and this corresponded to the time the bleeding started from the uterus. Apart from the presence of a tumour the patient suffered no discomfort. The wound healed up by first intention, and the patient was discharged from hospital three weeks after admission getting very well.

*Case iv.*—Seeman (Sinhalese), aged 6 years, was admitted into the Children’s Hospital on October 23, 1924, having been brought in a bullock cart from a village 13 miles north of Colombo with a history of having had fever for eight days and abdominal pain for three days. On admission his pulse was 120 and temperature  $101\cdot 4$ , abdomen was very distended, rigid and tender all over. Bowels had not moved for two or three days and an enema was given with a “peasoupy,” result on the morning of October 24, 1924, pulse was 98 and temperature  $97\cdot 8$  and abdomen were still tender and rigid. By 2 P.M. pulse was 120 and the patient was crying out with abdominal pain. Leparotomy was done immediately and the abdomen was found to be full of pus. Intestine was examined carefully and faeces were found oozing out of an aperture surrounded by a red area in the ilium about 3 inches above the ilio cæcal valve. The aperture was quickly closed with a purse-string silk suture.

The abdominal cavity was swabbed out as dry as possible and drainage tubes were inserted into Douglas pouch and the right and left iliac fossæ. Abdomen was closed except lower end for the tubes and the patient was nursed in the Fowler position. Saline glucose and soda bicarb were given four hourly per rectum.

October 27, 1924, blood was sent for Widal examination and the result was 1/40 positive, 1/80 negative. Temperature was normal and continued so. The wound discharged freely and rubber drainage was not got rid of till November 13, 1924. The patient progressed favourably, and the abdomen wound healed without any complication. The child was circumcised and discharged fit from the hospital on December 11, 1924.

56. *Stovarsol in Amœbiasis*, by Dr. Frank Grenier, Senior Physician, General Hospital, Colombo.

It has long been recognized that infections with *Entamoeba histolytica* once established are remarkably persistent. Spontaneous disappearance of the parasites has never been proved to occur, and many cases are known in which an infection has lasted for years—certainly for 16 years—and probably for much longer periods.

The results of treatment of these refractory cases of chronic amoebic dysentery, and of chronic non-dysenteric amoebiasis have often proved disappointing. The experience of recent years, and the knowledge gained by systematic examination of stools in cases of chronic amoebiasis have shown how this condition may clinically simulate sprue, and that its symptomatology, apart from dysenteric manifestations, is very complex and may imitate almost any gastro-intestinal disturbance, and that it is responsible for much chronic invalidism in the tropics.

Neither Emetine nor Emetine-Bismuth Iodide, nor the newer preparation Emetine Periodide are specific cures for amoebiasis. They are valuable drugs, but they do not always eradicate the infection or prevent relapses. For the incurable residue other methods of treatment had to be devised. Workers in France some years ago had recommended Salvarsan in the treatment of these cases, but such treatment did not enjoy a long vogue.

In 1923 Professor Marchoux of the Pasteur Institute having observed the good effects of Stovarsol given by the mouth in Syphilis was stimulated to try it in amoebic dysentery. In his first case thus treated the cysts of *Entamoeba Histolytica*, which had persisted after a course of Emetine, rapidly disappeared and success was equally remarkable in chronic cases of amoebic dysentery.

Stovarsol or oxyaminophenylarsenic acid is but slightly toxic, easy to take and after an extended use I have not observed any detrimental effect which can be attributed to the drug.

Report of some cases of chronic amoebiasis treated in hospital during the year with Stovarsol :—

*Case i.*—F. W., Burgher, dysentery, 10 years ago. Mother died of sprue. During last two years has been treated for sprue, sore tongue, and morning diarrhoea, bulky pale frothy stools, emaciation. While in hospital undergoing treatment for sprue—Parathyroid and Calcium and diet—his stools were daily examined. On the 11th examination typical cysts were found. A regular course of Stovarsol was prescribed and continued after discharge. Patient improved rapidly, is now doing a full day's work and on practically ordinary diet, and repeated examination of faeces have been negative.

As regards the resemblance of chronic Amœbiasis to sprue, I may quote the views of Acton and Knowles of the Calcutta School of Tropical Medicine :—“Whilst sprue appears to be a clinical entity may not it be the end phase of several different infections, e.g., with the Flexner Bacillus, or after chronic amoebic dysentery associated with pancreatic and parathyroid deficiency.”

*Case ii.*—Recurring dysentery of two years' duration. In spite of several courses of Emetine, Intravenous Salvarsan, colonic irrigations, &c., the condition tended to relapse. Rapid improvement under Stovarsol and restoration to normal health.

This patient was a Municipal employee, and the Municipal Bacteriologist informs me that repeated examinations of the faeces have given a negative result and that moreover a very chronic dermatitis the patient had, had disappeared. These skin conditions are met with in Amœbiasis, and are probably due to secondary streptococcal lesions in the bowel and absorption of “pressor” bases.

*Case iii.*—Recurring dysentery of five years' duration. Attacks every three or four months—an Assistant at the Bacteriological Institute. Cysts could always be demonstrated in his faeces. Treated with Stovarsol. Numerous repeated examination of stools now “negative.” No recurrence for nearly one year.

*Case iv.*—Female. Dysentery ten years ago. Recurring attacks of diarrhoea, last six months persistent diarrhoea. On admission extreme emaciation, hectic fever, prostration, a “living skeleton.” Condition thought to be either sprue or abdominal tuberculosis. On eighth examination of faeces, cysts found. Improvement, though slow, was sure, and patient, who has been recently, had put on weight and was free of symptoms. This case was treated with “Yatren” and not Stovarsol.

*Case v.*—European, male. Complained of dyspepsia and had symptoms of neurasthenia. Illness of six years' duration and dated back to War Service in Egypt. Referred to his condition as “Egyptian Tummy.” This case was one of chronic amoebiasis where marked constipation, rather than diarrhoea was a symptom. Cysts found. Improved, and now in good health.

*Case vi.*—Female, English. Ill for four years with “Colitis.” Appendix removed last year, no benefit from operation. This case is illustrative of the fact that chronic amoebiasis may give rise to symptoms and signs of chronic appendicitis. Patient improved, stools became normal in character and frequency and were on repeated examinations “negative” for cysts. However, for a considerable time the patient's general health remained poor, and she manifested symptoms characteristic of the “confirmed abdominal neurasthenic,” the condition being probably due to Endocrine deficiency, the result of chronic intestinal sepsis. Many such cases of chronic amoebiasis finally drift into the “chronic abdominal type.” One such case after “suffering many things at the hands of many physicians” finally received salvation and restoration to health from Christian Science. I may mention that in a recent case of chronic amoebiasis with symptoms of chronic appendicitis, the appendix was removed, and numerous active motile amoebia were found in the appendix, which was thickened and showed signs of chronic inflammation.

*The Misuse of Emetine.*—Whilst Emetine is a most valuable drug it is not sufficiently realized that it is a powerful cardiac and central nervous system depressant. The Emetine is often given without justification for its use, often on the mere strength of symptoms of hepatic or intestinal disorder, is to be deprecated. I have personally known of two cases of fatal cardiac failure from overdosing with Emetine.

*Stovarsol in Acute Amœbic Dysentery.*—I have not given Stovarsol a trial in cases of acute dysentery. It is the practice of some French medical men to give a continued course of Emetine and Stovarsol. It is claimed, however, that Stovarsol is so efficient and so easy to give by the mouth that patients in private practice and those who cannot come often to hospital are treated with Stovarsol alone.

57. *Report of the Malariaologist, Mr. H. F. Carter: Scientific Section.*—The information included in this section comprises brief summaries of certain investigations undertaken during the past year or more. The results of these and of other investigations will be published in detail later, and will include a series of articles in the Ceylon Journal of Science.

*Endemic Prevalence of Malaria in Ceylon.*—The relative prevalence of malaria in different parts of the Island as determined by spleen and blood examinations of random samples of children is shown in the table below. The majority of these examinations were made in connection with a preliminary survey during the period July, 1921, to July, 1922, when owing to limitations of staff and the extensiveness of the area involved it was not possible to synchronize the work with climatic conditions or to complete it within either of the monsoon periods. For these reasons the examinations were not in all cases strictly comparable, and factors—*e.g.*, recoveries, relapses, &c.—influencing the rates were operating in varying degrees in different districts when the work was performed. The results of continued work in this connection, however, have not affected the figures given in the report for 1922 to any appreciable extent, and it may perhaps be justifiable to assume, therefore, that, as applied to the extensive areas mentioned and except as indicated below, the findings afford a fairly reliable estimate of the prevalence of the disease. Nevertheless, local and seasonal variations may be considerable (*e.g.*, Trincomalee, page 7), and apparently are particularly liable to occur in areas of relatively low or moderate endemicity.

*Endemic Prevalence of Malaria in Ceylon.*

| Provinces.   | Spleen.            |                  |              | Blood.             |                  |                |      |
|--|--------------------|------------------|--------------|--------------------|------------------|----------------|------|
|  | Children examined. | Number Positive. | Spleen Rate. | Children examined. | Number Positive. | Parasite Rate. |      |
| Western ..   | .. 18,414          | .. 254           | .. 1·4       | .. 1,068           | .. 25            | .. 2·3         |      |
| Southern—  |                    |                  |              |                    |                  |                |      |
| (a) Wet-zone (over 75 in. rainfall)                | .. 5,052           | .. 197           | .. 3·7       | .. 125             | .. 1             | .. 0·8         |      |
| (b) Dry-zone (less than 75 in. rainfall)           | .. 1,387           | .. 370           | .. 26·5      | .. 134             | .. 14            | .. 10·5        |      |
| Sabaragamuwa ..                                    | .. 4,437           | .. 451           | .. 10·2      | .. 267             | .. 30            | .. 11·2        |      |
| Central—   |                    |                  |              |                    |                  |                |      |
| (a) Below 500 metres ..                            | .. 813             | .. 152           | .. 18·7      | .. 144             | .. 32            | .. 22·2        |      |
| (b) 500–1,000 metres ..                            | .. 3,443           | .. 242           | .. 7·0       | .. 154             | .. 11            | .. 7·1         |      |
| (c) Over 1,000 metres ..                           | .. 744             | .. 8             | .. 1·1       | .. 10              | .. —             | .. —           |      |
| Uva—   |                    |                  |              |                    |                  |                |      |
| (a) Below 500 metres ..                            | .. 245             | .. 138           | .. 56·3      | .. 22              | .. 4             | .. 18·2        |      |
| (b) 500–1,000 metres ..                            | .. 1,116           | .. 96            | .. 8·6       | .. 308             | .. 43            | .. 14·0        |      |
| (c) Over 1,000 metres ..                           | .. 448             | .. 8             | .. 1·8       | .. 30              | .. 1             | .. 3·3         |      |
| Northern—  |                    |                  |              |                    |                  |                |      |
| (a) North and north-west portions of peninsular .. | .. 4,176           | .. 359           | .. 8·6       | .. 306             | .. 43            | .. 14·0        |      |
| (b) Elsewhere ..                                   | .. 3,232           | .. 1,034         | .. 32·0      | .. 342             | .. 59            | .. 17·3        |      |
| North-Central ..                                   | .. 1,807           | .. 955           | .. 52·7      | .. 601             | .. 176           | .. 28·8        |      |
| North-Western ..                                   | .. 5,785           | .. 2,084         | .. 36·2      | .. 754             | .. 114           | .. 15·2        |      |
| Eastern ..   | .. 5,273           | .. 1,288         | .. 24·4      | .. 775             | .. 131           | .. 16·9        |      |
|  | Total ..           | 56,372           | 7,636        | 13·6               | 5,040            | 684            | 13·5 |

It will be observed from the table that the endemicity of malaria varies considerably in different parts of the Island, and that in certain areas at least, such variations are coincident with changes in climatic and topographical conditions. Broadly speaking the following areas of endemicity—as indicated by the spleen rate—may be distinguished:—

A.—Low-country (0–200 metres).

- (1) Wet-zone. Precipitation during both the south-west (April–June), and north-east (September–December) monsoons.
  - (a) The south-west portion of Ceylon extending from the coast to the submontane district of Sabaragamuwa, and including almost the whole of the Western Province, and the western half of the Southern Province.  
Endemicity low, the spleen rates varying from 0–10 per cent.  
(In this area the annual rainfall varies from 70–200 in., but throughout the greater part averages over 100 in.; precipitation is heavy during both monsoons).
  - (b) Two areas adjoining the above on the north and south-east respectively; the former including the northern limits of the Western and Sabaragamuwa Provinces, and the southern portion (as far north as Kurunegala) of the North-Western Province, the latter a small portion of the Southern Province.  
Endemicity moderate to high, the rates ranging from over 10–40 per cent.  
(The influence of the south-west monsoon in these areas is reduced and the dry season more pronounced; the annual average rainfall varies from 50–100 in., but is rarely over 85 in.).
- (2) Dry-zone. Precipitation mainly or entirely during the north-east monsoon, the dry season long and pronounced; annual average rainfall, 35–75 in.
  - (a) The north and north-west portions of the Jaffna peninsula.  
Endemicity low, spleen rates 0–10 per cent.
  - (b) The eastern littoral extending from Trincomalee in the north to the neighbourhood of Pottuvil in the south.  
Endemicity moderate to high, spleen rates 10–40 per cent.
  - (c) The very extensive area comprising the remainder of the dry-zone. It includes the eastern half of the Southern Province, the whole of the low-country of Uva Province, the greater part of the Eastern Province, the North-Central Province, the central and northern portions of the North-Western Province, and most of the Northern Province.  
Endemicity high or very high (hyperendemicity), the spleen rates ranging from 40–60 per cent. or over.  
(This area embraces almost two-thirds of the entire Island; it is sparsely populated and largely undeveloped including enormous tracts of jungle.)

B.—*Hill-Country.*

(a) *Elevation 200–500 Metres.*—An irregular and restricted area surrounding the central range of hills; it includes the northern portion of the Central Province, and the submontane districts of Sabaragamuwa and Uva Provinces. Endemicity moderate, the rates ranging from 10–20 per cent., higher (20–40 per cent.) in certain localized districts.

(b) *Elevation 500–1,000 Metres.*—The central and north-central portions of the Central Province, and small areas in Sabaragamuwa (Rakwana, &c.) and Uva (Badulla, Passara). Endemicity low to moderate, the spleen rates from 5–20 per cent.

(c) *Elevation Over 1,000 Metres.*—An extensive area including the southern portion of the Central Province and part (Namunukula, &c.) of Uva Province. Endemicity low, the rates varying from 0–5 per cent.

A comparison of the rates given above with those in the table will show that in certain areas apparent discrepancies exist. This is due to the fact that the figures in the table are not in all cases representative for the whole of the individual areas under consideration owing to the irregular distribution of the inhabitants. This is notably the case in those Provinces which include large tracts of jungle where the population is sparse and scattered, e.g., the Southern Province (dry-zone), the Northern Province (exclusive of the northern portion of the peninsula), and the Eastern Province. In such areas the examinations in the interior jungle districts are naturally much less numerous than those in the more restricted and less malarious districts, and their results are correspondingly affected when the entire region is considered. In all such districts malaria is highly endemic.

*Splenic Values.*—The determination of the spleen rate (of children from 2–10 years of age), although of great practical value as a means of measuring the amount of malaria present in any given district, does not afford a true indication of the intensity of the disease, since the exact signification of the rate is unknown. When, however, the size of the enlarged spleen is observed, more valuable and precise information at once becomes available, as it has been shown that a definite mathematical relationship exists between the size of the spleen and the spleen rate. The proportions of the different classes of spleens change regularly with the spleen rate, ensuring for individual rates a comparatively stable formula. The latter, however, may be considerably influenced by certain factors, e.g., non-representation of the community examined particularly in regard to the inclusion in communities with low spleen rates of children from highly malarious districts, or the presence of some other disease productive of severe splenomegaly; and when such are present the proportions of the different classes of spleens may be at complete variance with those for the observed spleen rate. In the table given below is shown the distribution of the different sized spleens according to spleen rates as determined from the examinations performed in connection with the inquiry into endemic prevalence.

*Sizes of Spleens—Actuals.*

## Classes of Spleens.

| Spleen Rate Group. | Children examined. | Normal.   | One Finger Breadth. | Two Finger Breadths. | Three Finger Breadths. | Four Finger Breadths. | Hand Breadths. | Beyond Umbilicus. |
|--------------------|--------------------|-----------|---------------------|----------------------|------------------------|-----------------------|----------------|-------------------|
| 0                  | .. 11,408          | .. 11,408 | — ..                | — ..                 | — ..                   | — ..                  | — ..           | — ..              |
| 0—10               | .. 22,506          | .. 21,813 | 525 ..              | 143 ..               | 24 ..                  | 1 ..                  | — ..           | — ..              |
| 10—20              | .. 7,527           | .. 6,478  | 712 ..              | 267 ..               | 52 ..                  | 17 ..                 | 1 ..           | — ..              |
| 20—30              | .. 3,866           | .. 2,835  | 525 ..              | 345 ..               | 122 ..                 | 27 ..                 | 12 ..          | — ..              |
| 30—40              | .. 1,865           | .. 1,210  | 294 ..              | 233 ..               | 94 ..                  | 33 ..                 | 1 ..           | — ..              |
| 40—50              | .. 2,151           | .. 1,186  | 438 ..              | 333 ..               | 140 ..                 | 43 ..                 | 9 ..           | 2 ..              |
| 50—60              | .. 2,628           | .. 1,225  | 510 ..              | 561 ..               | 221 ..                 | 88 ..                 | 20 ..          | 3 ..              |
| 60—70              | .. 612             | .. 210    | 133 ..              | 152 ..               | 63 ..                  | 40 ..                 | 14 ..          | — ..              |
| 70—80              | .. 515             | .. 131    | 113 ..              | 141 ..               | 79 ..                  | 39 ..                 | 12 ..          | — ..              |
| 80—90              | .. 667             | .. 106    | 145 ..              | 211 ..               | 141 ..                 | 44 ..                 | 17 ..          | 3 ..              |
| 90—100             | .. 216             | .. 15     | 35 ..               | 73 ..                | 50 ..                  | 32 ..                 | 7 ..           | 4 ..              |
| Total              | .. 53,961          | .. 46,617 | 3,430               | 2,459                | 986                    | 364                   | 93             | 12                |

These figures interpreted as percentages of the enlarged spleens are as follows:—

*Percentage Proportion of Each Class of Spleen to Total enlarged.*

## Classes of Spleen.

| Spleen Rate Group. | One Finger Breadth. | Two Finger Breadths. | Three Finger Breadths. | Four Finger Breadths. | Hand Breadths. | Beyond Umbilicus. |
|--------------------|---------------------|----------------------|------------------------|-----------------------|----------------|-------------------|
| 0—10               | .. 75.8 ..          | 20.6 ..              | 3.5 ..                 | 0.1 ..                | — ..           | — ..              |
| 10—20              | .. 67.9 ..          | 25.4 ..              | 5.0 ..                 | 1.6 ..                | 0.1 ..         | — ..              |
| 20—30              | .. 50.8 ..          | 33.4 ..              | 11.8 ..                | 2.6 ..                | 1.2 ..         | — ..              |
| 30—40              | .. 44.8 ..          | 35.6 ..              | 14.3 ..                | 5.0 ..                | 0.2 ..         | — ..              |
| 40—50              | .. 45.2 ..          | 34.6 ..              | 14.5 ..                | 4.5 ..                | 0.9 ..         | 0.2 ..            |
| 50—60              | .. 36.3 ..          | 40.0 ..              | 15.7 ..                | 6.3 ..                | 1.4 ..         | 0.2 ..            |
| 60—70              | .. 33.0 ..          | 37.9 ..              | 15.7 ..                | 9.9 ..                | 3.5 ..         | — ..              |
| 70—80              | .. 29.4 ..          | 36.8 ..              | 20.6 ..                | 10.1 ..               | 3.1 ..         | — ..              |
| 80—90              | .. 25.8 ..          | 37.6 ..              | 25.1 ..                | 7.8 ..                | 3.2 ..         | 0.5 ..            |
| 90—100             | .. 17.4 ..          | 36.3 ..              | 24.9 ..                | 15.9 ..               | 3.5 ..         | 2.0 ..            |

The changes in the spleen composition (exclusive of obvious discrepancies) shown above correspond fairly closely with those found by Christophers in India and Mesopotamia, although there appears to be a definite decrease in the proportions of large-sized spleens for each group of spleen rates. From the data given in the above tables the following splenic values for Ceylon have been calculated \* :—

*Calculations of Splenic Values.*

| Spleen Rate Group. | Children examined. | Number with enlarged Spleen. | Average Spleen Rate for Group. | Number of Splens distributed. | Increased Splenic Substance per 100 Children examined (Grammes). | Average enlarged Spleen (Grammes). | Calculated Value of Spleen for Group (Grammes). |
|--------------------|--------------------|------------------------------|--------------------------------|-------------------------------|--|------------------------------------|---|
| 0—10               | 22,506             | 693                          | 3·1                            | 3·1                           | 209  | 118                                | 67·4  |
| 10—20              | 7,527              | 1,049                        | 13·9                           | 14·9                          | 1,087  | 128                                | 72·9  |
| 20—30              | 3,866              | 1,031                        | 26·8                           | 31·1                          | 2,692  | 151                                | 86·5  |
| 30—40              | 1,865              | 655                          | 35·1                           | 40·8                          | 3,817  | 159                                | 93·5  |
| 40—50              | 2,151              | 965                          | 44·8                           | 59·2                          | 4,994  | 161                                | 84·3  |
| 50—60              | 2,628              | 1,403                        | 53·5                           | 76·2                          | 6,630  | 174                                | 87·0  |
| 60—70              | 612                | 402                          | 65·6                           | 106·3                         | 9,308  | 191                                | 87·5  |
| 70—80              | 515                | 384                          | 74·5                           | 136·1                         | 10,992   | 197                                | 87·6  |
| 80—90              | 667                | 561                          | 84·0                           | 182·5                         | 12,683   | 201                                | 69·5  |
| 90—100             | 216                | 201                          | 93·0                           | 264·9                         | 17,222   | 235                                | 65·0  |

According to Christophers a *splen* is the mean increase in splenic substance resulting from a single infection (untreated) in a child 2—10 years of age, and the number of *splens* distributed is a direct measure of the intensity of malarial infection. The value of the *splen* being known the latter may easily be calculated, and from this the spleen rate corresponding to the spleen composition may be obtained. The average values of the *splen* in India and Mesopotamia have been determined at 90 and 114 grammes, respectively, while that for Ceylon—owing to the difference in size of enlarged spleens noted above—is less, being approximately 80 grammes.

*The Relative Prevalence of the Different Species of Malarial Parasites.*—The relative prevalence of the various forms of malaria in Ceylon as observed from the distribution of the different species of parasites in blood films taken from persons (children and adults by random sampling, and hospital and dispensary cases) in various parts of the Island is given below :—

*Proportional Distribution of Malaria Parasites.*

| Province.   | Films examined. | Films Positive. | Benign Tertian (Per Cent.). | Quartan (Per Cent.). | Sub-tertian (Per Cent.). | Multiple Infections.  |
|---|-----------------|-----------------|-----------------------------|----------------------|--------------------------|---|
| Western ..  | 1,607 ..        | 51 ..           | 84·3 ..                     | 11·8 ..              | 5·9 ..                   | 1 B.T. and M.T.   |
| Southern—   |                 |                 |                             |                      |                          |   |
| (a) Wet zone (over 75 in. rainfall) ..            | 275 ..          | 33 ..           | 63·6 ..                     | 27·3 ..              | 9·1 ..                   | —   |
| (b) Dry zone (less than 75 in. rainfall) ..       | 179 ..          | 17 ..           | 76·5 ..                     | 17·6 ..              | 5·9 ..                   | —   |
| Sabaragamuwa ..                                   | 329 ..          | 49 ..           | 69·4 ..                     | 20·4 ..              | 10·2 ..                  | —   |
| Central—  |                 |                 |                             |                      |                          |   |
| (a) Below 500 metres ..                           | 180 ..          | 47 ..           | 57·4 ..                     | 36·2 ..              | 6·4 ..                   | —   |
| (b) 500—1,000 metres ..                           | 216 ..          | 18 ..           | 72·3 ..                     | 22·2 ..              | 5·5 ..                   | —   |
| (c) Over 1,000 metres ..                          | 10 ..           | — ..            | — ..                        | — ..                 | — ..                     | —   |
| Uva—  |                 |                 |                             |                      |                          |   |
| (a) Below 500 metres ..                           | 79 ..           | 11 ..           | 27·3 ..                     | 54·5 ..              | 18·3 ..                  | —   |
| (b) 500—1,000 metres ..                           | 892 ..          | 240 ..          | 61·3 ..                     | 25·8 ..              | 14·5 ..                  | 1 B.T. and Q.   |
| (c) Over 1,000 metres ..                          | 30 ..           | 1 ..            | — ..                        | — ..                 | — ..                     | 3 B.T. and M.T.   |
| Northern—   |                 |                 |                             |                      |                          |   |
| (a) North and north-west portions of peninsula .. | 1,160 ..        | 234 ..          | 62·0 ..                     | 30·4 ..              | 8·1 ..                   | 1 B.T. and Q.   |
| (b) Elsewhere ..                                  | 525 ..          | 118 ..          | 62·7 ..                     | 30·5 ..              | 6·8 ..                   | —   |
| North-Central ..                                  | 1,377 ..        | 344 ..          | 50·6 ..                     | 44·2 ..              | 10·8 ..                  | 16 B.T. and Q. ; 1 Q. and M.T. ; 1 B.T. ; Q. ; & M.T.                   |
| North-Western ..                                  | 1,371 ..        | 247 ..          | 50·0 ..                     | 38·8 ..              | 11·7 ..                  | 1 B.T. and Q.   |
| Eastern ..  | 1,798 ..        | 230 ..          | 65·3 ..                     | 25·2 ..              | 9·5 ..                   | —   |
| Totals ..   | 10,028 ..       | 1,640 ..        | 59·0 ..                     | 32·3 ..              | 10·2 ..                  | 4 B.T. and M.T. ; 19 B.T. and Q. ; 1 Q. and M.T. ; 1 B.T. ; Q. ; & M.T. |

The results of these examinations show that in every district the benign forms (Benign Tertian and Quartan) of malaria predominate; malignant or subtertian malaria appears to be relatively uncommon, averaging only slightly over 10 per cent. of all infections observed. The figures now given differ in several respects, especially in regard to the relative prevalence of quartan malaria, from those in the report for 1922; but all such discrepancies are evidently due to the comparatively small numbers of "positive" films which were available for analysis at that time.

The relative scarcity of malignant malaria in Ceylon is a matter of considerable interest and importance, since in most tropical countries this form of the disease preponderates, and is concomitant with a high prevalence of pernicious cases and severe mortality. It is, moreover, considered by some authorities that the parasite (*Plasmodium falciparum*) responsible for this form of malaria is the chief causal factor of blackwater fever, and that the presence of this organism in a high proportion of infections

\* These calculations are based upon the values and formulæ proposed by Christophers. (Indian Journal of Medical Research. Vol. II., 1915, p. 823.)

† In considering these results it will be noted that the percentages given do not, in cases where multiple infections occur, total exactly to 100; this is due to the fact that each species of parasite is treated separately in regard to the number of infected cases observed.

B.T. = Benign Tertian; Q = Quartan; M.T. = Malignant or Subtertian Malaria.

is necessary for the production of this condition. If this view be correct the almost complete absence of blackwater fever from Ceylon—even from those districts where malaria is hyperendemic—may readily be explained by the results shown above. It is very probable, however, that the percentage proportions of the various species of parasites in the different areas mentioned are subject to seasonal fluctuations, and that at certain times any one species may become more prevalent; but the evidence at present available indicates that in the case of malignant malaria a widespread increase sufficiently great to render it the predominating form is not a common occurrence.

*The Differential Characters of the Indigenous Anopheline Mosquitoes in their Adult and Larval Stages.*—Fifteen species, and their varieties, of Anopheles have now been found in Ceylon. Of these, nine are abundant including two (*A. maculatus* and *A. gigas*) which are confined to the hill-country. In the low-country, although the same species occur in both the wet and the dry zones, they are present in very different proportions. In the wet zone *A. listoni* and *A. culicifacies* are relatively uncommon, and are to a great extent replaced by the comparatively innocuous swamp-breeding species, *A. jamesi*, *A. hyrcanus*, and *A. barbirostris*. Proceeding from the wet zone to the dry zone districts, the proportions of the various species gradually change, those of *A. subpictus*, *A. listoni*, *A. culicifacies*, and *A. fuliginosus* being increased, while those of the “swamp breeders” mentioned above are correspondingly reduced. It would appear probable that this change in the composition of the Anopheline fauna is a factor of fundamental importance in connection with the relative freedom of the low-country wet zone (*i.e.*, the south-west portion of Ceylon, see page 54) from malaria, and it is of interest to note that in several instances (*e.g.*, Mutwal, 1903; Mahara Jail, 1922; Dematagoda, 1923) during recent years when localized epidemics have occurred in this part of the country, conditions have been present which especially favoured the propagation of *A. culicifacies* or *A. listoni*.

The more important distinguishing characters of the adults and mature larvae of the indigenous Anopheles are summarized in the following tables:—

#### *Synopsis of Adults.*

- (1) Wing entirely dark, or the upper margin with not more than three pale spots; cross-veins and bases of forks of veins dark (sub-genus *Anopheles*).
  - Wings with at least four pale spots on the upper margin; cross-veins and bases of forks of veins pale (sub-genus *Myzomyia*).
- (2) Wings without pale spots; uniformly brown in colour (*aitkeni James*).
  - Wings with light and dark spots.
- (3) Wings with three pale spots on the upper margin, the markings sharply defined; large species (*gigas Giles*).
  - Wings with at most two pale spots on the upper margin, the markings not sharply defined; medium sized or large species.
- (4) Hind legs with a dense tuft (black and white) of outstanding scales on the femora (*annandalei Pras*).
  - Hind legs normal, without a tuft of outstanding scales.
- (5) Femora, tibiae and first tarsal segments of all the legs conspicuously spotted with yellow (*pseudo-barbirostris Lud*).
  - Femora, tibiae and first tarsal segments with pale spots at their extremities only.
- (6) Palpi in female entirely black, shaggy scaled, in male black with an indistinct ring on the proximal portion; wings with black and white scales, the black preponderating; large blackish species (*barbirostris Wulp*).
  - Palpi in female with narrow pale rings, in male with distinct rings and the apex of the club white, wings with black and yellow scales, the yellow preponderating on the lower portion of the wing; medium sized to large, dark brown species (*hyrcanus Pall*).
- (7) Femora and tibiae with pale spots at or near their extremities only.
  - Femora and tibiae conspicuously spotted throughout with white or yellow.
- (8) Tarsal segments of all the legs entirely dark
  - Tarsal segments with distinct pale rings.
- (9) Thorax brown; palpi in female with three narrow widely separated rings, in male with pale rings, the club mainly dark scaled; base of first vein mainly black, fringe dark or with one or two indistinct pale spots (*culicifacies Giles*).
  - Thorax mainly gray; palpi in female with three pale rings, the two terminal ones broad and narrowly separated, in the male with pale rings, the club mainly yellowish; base of first vein yellow, fringe with several conspicuous pale spots.
- (10) Proboscis entirely dark, sometimes paler beneath the apical half; fringe without a pale spot opposite the six vein (*funestus var. listoni List*).
  - Proboscis conspicuously pale (golden) on the apical half; fringe with a pale spot opposite the sixth vein (*funestus var. aconitus Don*).
- (11) Tips of the hind legs dark; pale bands on tarsal segments of fore legs broader than those on the hind legs.
  - At least the tips of the hind legs white; pale bands on tarsal segments of fore legs narrower and less conspicuous than those on the hind legs.
- (12) Palpi in female with three pale rings, the apical ring not more than  $1\frac{1}{2}$  times the length of the adjoining black band; proboscis uniformly dark; fringe usually with an extra pale spot between the fifth and sixth veins; tibiae and first tarsal segments with conspicuous longitudinal striping (*subpictus Grassi*).
  - Palpi in female with three pale rings, the apical ring very broad, at least three times the length of the adjoining band; proboscis in female with a pale area before the apex; fringe usually without a pale spot between the fifth and sixth veins; tibiae and first tarsal segments without pronounced striping (*subpictus var. vagus Don*).
- (13) Hind legs with the last three tarsal segments entirely white; palpi in female with three white rings (*fuliginosus Giles*).
  - Hind legs with the tip (last segment) only white; palpi in female with four white rings (*karwari James*).
- (14) Pale markings on the second to sixth veins extensive; often forming relatively large bars; sixth vein with not more than three dark spots.
  - Pale markings on the second to sixth veins interrupted by very numerous small black spots; sixth vein with at least four dark spots.

(15) Hind legs with the last three tarsal segments entirely white; palpi in female with three white rings the second narrow and widely separated from the apical ring (*jamesi Theob.*).  
Hind legs with the tip (last segment) only white; palpi in female with three white rings, the apical ones broad and narrowly separated (*maculatus Theob.*).

(16) Hind legs with a very broad white band covering the tibiotarsal joint (*leucosphyrus Don*).  
Hind legs without such a band (*punctulatus var. tessellatus Theob.*).

*Synopsis of the Mature Larvæ.*

(1) Shaft of antenna with a branched hair, or if absent the post-antennal hairs short and inconspicuous. (Sub-genus *Anopheles*).  
Shaft of antenna without a branched hair, the post-antennal hairs always long and conspicuous. (Sub-genus *Myzomyia*).

(2) Shaft of antenna without a branched hair, post-antennal hairs small; thorax and abdomen completely covered with minute curved setæ (*annandalei Pras.*).  
Shaft of antenna with a branched hair, post-antennal hairs large; thorax and abdomen without setæ.

(3) Outer clypeal hairs with a few short branches, or simple; hair on antenna arising near base of shaft. Outer clypeal hairs thickly branched dendri form; hair on antenna arising near middle of shaft.

(4) Thoracic palmate hair vestigial with four or five hair-like divisions; abdominal palmate hairs with leaflets terminating bluntly; large species (7 mm.) (*gigas Giles*).  
Thoracic palmate hair well-defined with several (10–14) narrow leaflets; abdominal palmate hairs with leaflets terminating in definite filaments or very sharp points; small species (3·5 mm.)... 5.

(5) Inner and outer clypeal hairs branched, the former usually bifurcating before the middle (*aitkeni James*).  
Inner and outer clypeal hairs simple (*aitkeni var. insulæflorum Swel.*).

(6) Innermost sub-median anterior thoracic hairs branched (6·8 divisions) from or near the base; black with white markings (*barbirostris Wulp*).  
Innermost sub-median anterior thoracic hairs simple, or with two or three very short branches arising on the distal portion of the stem; yellowish-green or yellowish-brown without definite white markings (*hyrcanus Pall*).

(7) Abdominal tergal plates very large, occupying from nearly one-half (first segment) to almost the whole (eighth segment) of the dorsal surface of the segments  
Abdominal tergal plates smaller, those on the anterior segments reduced to narrow transverse bars.

(8) Inner and outer clypeal and pre-antennal hairs simple, or (intermediate form) with a few short branches, those on the pre-antennal hairs arising at intervals along the stem (*funestus var. listoni List*).  
Inner and outer clypeal hairs with more numerous short branches, pre-antennal hair branched (5 or 6 divisions) from the base (*funestus var. aconitus Don*).

(9) Outer clypeal hairs simple, or with a few short branches only; pre-antennal hairs simple, or with faint lateral branching.  
Outer clypeal hairs thickly branched, plumose; pre-antennal hairs branched, usually from the base

(10) Inner and outer clypeal hairs simple, or the inner only with fine short, lateral branches; thoracic palmate hair (except *A. subpictus*) small, but with definite leaflets.  
Inner and outer clypeal hairs with short lateral branches; thoracic palmate hair with hair-like divisions only

(11) Anterior clypeal and pre-antennal hairs always simple; leaflets of abdominal palmate hairs ending in long filaments.  
Inner clypeal hairs usually with short branches; leaflets of abdominal palmate hairs ending in blunt points.

(12) Thoracic palmate hair vestigial, with long hair-like branches; sub-median thoracic hairs scarcely pigmented, the innermost without a conspicuous dark root; antennæ feebly chitinized, unpigmented.  
Thoracic palmate hair small, but with six to eight short leaflets; sub-median thoracic hairs powerful, pigmented, the innermost with a conspicuous dark root; antennæ strongly, chitinized, the tips dark (*culicifacies Giles*).

(13) Pre-antennal hairs situated below or outside the inner clypeal hairs; outer clypeal hair long—from  $\frac{2}{3}$  to  $\frac{4}{5}$  the length of the inner (*subpictus Grassi*).  
Pre-antennal hairs situated between the inner clypeal hairs; outer clypeal hair very short— $\frac{1}{4}$  or less the length of the inner (*subpictus var. vagus Don*).

(14) Innermost sub-median anterior thoracic hairs short, with two or three branches (occasionally simple) without conspicuous roots (*punctulatus var. tessellatus Theob.*).  
Innermost sub-median anterior thoracic hairs large with numerous branches and conspicuous roots. (*leucosphyrus Don*).

(15) Extremities of leaflets of abdominal palmate hairs sharply pointed or filamentous (*maculatus Theob.*).  
Extremities of leaflets of abdominal palmate hairs bluntly pointed (*karwari James*).

(16) Vertical clypeal hair long and simple, occasionally bifid; leaflets of palmate hair on first abdominal segment very narrow, usually hair like, 7–8 in number (*jamesi Theob.*).  
Vertical clypeal hair short, with four or five branches arising, usually, from the base; leaflets of palmate hair on first abdominal segment differentiated, 10–12 in number (*fuliginosus Giles*).

*The Relation of Paddy Cultivation to Malarial Endemicity.*—Investigations in this connection were conducted at several towns situated in different parts of the Island with a view to determining the effects of varying conditions upon the Anopheline fauna of the rice fields, and the relation of the latter to the incidence of malaria; they were commenced in August, 1922, and continued until November, 1924. The area under paddy at the centres selected varied considerably—from approximately 30 to several hundred acres. At each centre from 10 to 30 fields (varying in total area from one to three acres), situated in three or more blocks in different parts of the town were selected, mainly in accordance with their position in relation to dwellings and irrigation channels.

Examinations for Anopheles larvæ were made each month; they were not restricted to the rice fields alone, but included uncultivated fields, irrigation channels, swampy areas and pools produced by seepage, and various other types of potential breeding places in the vicinity. For the purpose of

summarizing the results obtained it is convenient to arrange the towns at which the investigations were made in five groups according to the climatic and physical characters (including methods of irrigation, &c.) of the areas in which the selected fields were situated :—

*Group 1.*—Hill-country (elevation 1,600–2,250 ft.) ; annual average rainfall 70–150 in. ; water supply from rains or streams ; endemic index ranging from 1–18 per cent.

*Group 2.*—Low-country (vicinity of foot-hills of central range—elevation 280–400 ft.) ; rainfall approximately 80–90 in. ; water supply mainly from rain and streams ; endemic index 20–50 per cent. Centres : Kurunegala, Polgahawela, Rambukkana.

*Group 3.*—Low-country wet zone (elevation 0–100 ft.) ; rainfall 85–150 in. ; water supply from rain and streams ; endemic index 0–5 per cent. Centres : Colombo, Panadure, Kalutara, Galle, Padukka, Ruwanwella, and Nambapana.

*Group 4.*—Low-country (northern plain, elevation 260 ft.) ; rainfall 55 in. ; irrigation from tanks ; endemic index 50 per cent. or over. Centre : Anuradhapura.

*Group 5.*—Low-country (coast towns, elevation 0–25 ft.) ; rainfall 50–60 in. ; water supply mainly rain ; endemic index 12–40 per cent. Centres : Jaffna, Batticaloa, Chilaw.

The gross results of these investigations—which involved the examination of many thousand samples in the field, and the identification of approximately 20,000 *Anopheles* larvæ—were as follows :—

(Percentage Prevalence of Identified Larvæ.\*)

| Species.               | Group I.<br>Fields. | Group II.<br>Channels. | Group III.<br>Fields. | Group III.<br>Channels. | Group IV.<br>Fields. | Group IV.<br>Channels. | Group V.<br>Fields. |
|------------------------|---------------------|------------------------|-----------------------|-------------------------|----------------------|------------------------|---------------------|
| <i>A. subpictus</i>    | .. 62·0 ..          | 32·1 ..                | 23·4 ..               | 4·6 ..                  | 4·1 ..               | 13·8 ..                | 36·0 ..             |
| <i>A. hyrcanus</i>     | .. 25·9 ..          | 23·0 ..                | 46·5 ..               | 27·6 ..                 | 34·6 ..              | 13·8 ..                | 40·9 ..             |
| <i>A. listoni</i>      | .. 6·6 ..           | 30·1 ..                | 21·6 ..               | 39·4 ..                 | 3·3 ..               | 6·2 ..                 | 15·0 ..             |
| <i>A. culicifacies</i> | .. 0·3 ..           | 0·1 ..                 | 0·5 ..                | 1·5 ..                  | 1·8 ..               | — ..                   | 1·5 ..              |
| <i>A. maculatus</i>    | .. 3·3 ..           | 12·7 ..                | 0·9 ..                | 0·1 ..                  | 0·7 ..               | — ..                   | 0·4 ..              |
| <i>A. fuliginosus</i>  | .. 0·7 ..           | 0·1 ..                 | 0·8 ..                | 0·5 ..                  | 0·2 ..               | 0·6 ..                 | 1·7 ..              |
| <i>A. jamesi</i>       | .. 1·2 ..           | 1·9 ..                 | 6·3 ..                | 26·2 ..                 | 54·7 ..              | 62·8 ..                | 4·9 ..              |
| <i>A. barbirostris</i> | ..                  | ..                     | ..                    | ..                      | ..                   | ..                     | 10·3 ..             |
| Other species          | .. — ..             | .. — ..                | .. — ..               | .. 0·1 ..               | .. 0·6 ..            | .. 3·0 ..              | .. — ..             |

An examination of the above table shows that, except in the wet zone (Group III.), the predominating species of *Anopheles* breeding in the rice fields are *A. subpictus* and *A. hyrcanus*, but that the more effective malaria transmitting species—*A. listoni*, *A. culicifacies*, and *A. maculatus*—when taken together form an appreciable percentage of the *Anopheles* fauna. In the irrigation channels the proportions of latter species in Groups 1, 2, and 4 are much greater, especially in those districts (Group 4) where the water supply is derived from tanks.

These results for the more dangerous species mentioned and for *A. fuliginosus*—which although apparently a less active carrier of malaria in nature may in certain circumstances become important—combined are shown in graphic form.

In many parts of the Island, therefore, it would appear at first sight that the irrigation channels themselves are more important factors in the production of malaria than the rice fields, but it is necessary to observe that the total prevalence of *Anopheles* larvæ of all kinds in the channels is in general considerably less than in the rice fields—a fact which, in practice, may tend to equalize matters. It has yet to be determined, however, whether the larvæ of the more important species occurring in the fields are derived primarily from the irrigation channels or exactly to what extent lack of control of the water supply is responsible for their propagation. In at least the areas represented by Groups 2 and 4, evidence is available which shows that the paludic conditions invariably associated with irrigation are seriously conducive to Anophelism of a dangerous type, and that much stricter control—particularly of the privately owned channels—will be necessary if the incidence of malaria is to be reduced.

The percentages given in the table are based on the total number of examinations made in each group, and thus indicate the average prevalence only of the various species of *Anopheles*. In the rice fields, however, they vary to a greater or less extent in the different areas chiefly according to the stage of cultivation and growth of the crop. The most definite change is in regard to the species *A. subpictus* and *A. hyrcanus*. Usually, during the early stages of cultivation when there is little or no growth and the water is stagnant and muddy, the predominant species is *A. subpictus*, but in most districts *A. hyrcanus* becomes more prevalent as the growth of vegetation increases, reaching its maximum abundance when the crop is sufficiently tall to shade the surface of the water. No very definite variations in the prevalence of the malaria carrying species have so far been observed.

Spleen and blood examinations of persons (children 2–12 years of age) living in close proximity to rice fields gave the following results :—

| Group. | Parasite Rate.           |                          | Spleen Rate.             |          | General. |
|--------|--------------------------|--------------------------|--------------------------|----------|----------|
|        | Vicinity of Rice Fields. | Vicinity of Rice Fields. | Vicinity of Rice Fields. | General. |          |
| I.     | ..                       | 6·6 ..                   | 6·2 ..                   | ..       | 8·0      |
| II.    | ..                       | 14·6 ..                  | 51·1 ..                  | ..       | 36·2     |
| III.   | ..                       | — ..                     | 5·3 ..                   | ..       | 1·4      |
| IV.    | ..                       | 25·0 ..                  | 52·7 ..                  | ..       | 52·0     |
| V.     | ..                       | 13·4 ..                  | 26·9 ..                  | ..       | 39·4     |

The above results, based on the examination of several hundred children, indicate that a definite increase in the endemicity of malaria in the vicinity of rice fields occurs in the cases of Groups II. and III., and that in other districts the disease is equally or even more prevalent elsewhere.

\* Excluding larvæ of the first instar, which are not identifiable.

In this connection, however, it is important to note that in those regions (Groups II., IV., and V.) of the low-country where malaria is more highly endemic, conditions—climatic, physical, and agricultural—vary considerably. The districts represented by Groups IV. and V. are situated in the dry zone where the rainfall is practically confined to the period of the north-east monsoon (November to March), and long periods of drought usually occur during the intervening months. In both regions, but particularly in that represented by Group IV., extensive areas are in an almost undeveloped condition and much of the land is covered with jungle growth. In the region typified by Group II., the annual rainfall is derived from both the south-west and north-east monsoons and is more evenly distributed throughout the year; and a large portion of the area is under cultivation or in process of development. Extended work on the distribution of mosquitoes in Ceylon has shown that the composition of the Anopheline fauna of these districts differs in certain important respects. The chief difference at present indicated is that throughout the "dry zone" (including Groups IV. and V.) the dangerous malaria-carrying species *A. culicifacies* is definitely more abundant than in other parts of the Island. This species is less common in the region typified by Group II., and moreover, in those areas where it is prevalent does not breed prolifically in paddy fields or irrigation channels; it is much more prevalent in other types of situations, such as pools, earth drains, and wells.

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Colombo, May 18, 1925.

PREVALENCE OF *A. LISTONI*, *A. CULICIFACIES*, *A. MACULATUS* & *A. FULIGINOSUS*,  
IN PADDY FIELDS AND IRRIGATION CHANNELS.

